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(54) **NEW PACKAGE FOR INSTANT ADHESIVES**

VERPACKUNG FÜR SOFORT HAFTENDE KLEBSTOFFE

NOUVEAU RECIPIENT POUR ADHESIF A PRISE INSTANTANEE

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(56) References cited:
CH-A- 404 525
DE-A- 2 906 818
DE-A- 3 202 072
US-A- 2 665 945
US-A- 3 578 224
US-A- 3 828 962
US-A- 3 930 599
US-A- 4 413 753
US-A- 5 154 327

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Description

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0001] The present invention relates to a new closure mechanism for packages. The invention is especially suited for instant adhesive packages and more particularly, the invention relates to a package for cyanoacrylates.

[0002] Cyanoacrylates can bond human skin; therefore, the adhesive package must be designed to prevent leakage. Also, because large surface areas can be bonded with minute quantities of adhesive, the package must be capable of accurately dispensing small quantities to exact locations.

2. Description of the Related Art

[0003] Although the invention relates to any-package that requires a closure mechanism, the invention will be described in terms of an adhesive package.

[0004] Currently, packaging of instant adhesives is done in aluminum tubes, pens and bottles. However, in aluminum tubes, the tip often must be pierced with a pin to open the tube. This necessitates either packaging a separate pin with the tube, or asking the user to find a pin or sharp object with which to open the tube. Typically users squeeze the tube as they are trying to pierce the tip; therefore, when the opening is punctured, unwanted adhesive will squirt out. This often creates a mess and can even be dangerous depending on the type of adhesive contained in the tube. Other disadvantages of tubes include the fact that the pierced ti easily clogs with adhesive that has dried or cured, and that the user is never sure of how much adhesive is left in the container. Pens have spring valves inside their tips which clod easily and also are not capable of directly dispensing in tight locations. DE 3202072 is directed to a closure for containers which can be fitted onto a container. The closure comprises a hollow projection which tapers conically towards its free end and is provided with an applicator plate across the top, with a central discharge hole. The cap is provided with a projecting closure pin which engages the central discharge hole of the applicator plate.

[0005] Traditional bottle designs often have leakage problems, and do not accurately dispense adhesive. Also, bottles frequently clog because stray adhesive partially cures around the tip causing the cap to bond to the nozzle. This makes subsequent openings of the bottle difficult. Some bottles have designs where the cap has a built in pin which fits directly into the opening of the bottle similar to the present invention. In these designs the user typically pulls the cap directly up and off the bottle. If the pin bonds to the opening or the cap bonds to the nozzle, due to the buildup of stray adhesive, the pressure applied to pull the cap up and off can cause the pin to break or shear. Also, the user will typically squeeze the bottle while attempting to open it and when the pin disengages from the opening, unwanted adhesive is liable to spurt out. Bottles which employ a threaded cap are especially susceptible to having stray adhesive cause unwanted bonding between the elements of the bottle because the surfaces of the threads provide areas where the adhesive can accumulate. Again, if the threaded cap design employs a built in pin, when the user tries to open a bottle in which the pin has bonded to the opening, the pin will be subject to strong rotational forces that can cause the pin to shear or break.

[0006] Therefore, there is a need for an instant adhesive package that does not require a separate pin to open, discourages the bonding of the cap to the nozzle, opens easily without breaking or shearing the pin even if the pin has been bonded to the opening of the bottle or the cap bonded to the nozzle, is non-clogging, protects against leakage, shows how much adhesive is left in the package and allows for precise dispensing of the product.

BRIEF SUMMARY OF THE INVENTION

[0007] The present invention provides a closure mechanism for a package which makes the package easy to open and close, leak proof and non-clogging. Also, the package is easy to dispense from, and provides a good shelf life for the product.

[0008] Other advantages of the invention will be better appreciated from a detailed description thereof which follows.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009] Fig. 1 is a perspective view of a package comprising a body and a cap in accordance with the present invention.

[0010] Fig. 2 is an elevational view of the package of Fig. 1.

[0011] Fig. 3 is an elevational side view of the package of Fig. 1.

[0012] Fig. 4 is a top plan view of the package of Fig. 1.

[0013] Fig. 5 is a perspective view of the body of Fig. 1.

[0014] Fig. 6 is an elevational view of the body of Fig. 2.

[0015] Fig. 7 is an elevational side view of the body of Fig. 3.

[0016] Fig. 8 is a top plan view of the body of Fig. 1.

[0017] Fig. 9 is a partial cross-sectional view of the package of Fig. 3 taken along the line 9-9.

[0018] Fig. 10 is a partial cross-sectional view of the package of Fig. 2 taken along the line 10-10.

[0019] Fig. 11 is a partial perspective view of the interior of the cap of Fig. 1.

[0020] Fig. 12 is a partial cross-sectional view of the package of Fig. 1.

[0021] Fig. 13 is a partial cross-sectional view of the upper portion of a second embodiment of the present invention.

[0022] Fig. 14 is a top plan view of a package of Fig. 13.

[0023] Fig. 15 is a cross-sectional view of the package of Fig. 1 in a partially disassembled state.

[0024] Fig. 16 is a cross-sectional view of the package of Fig. 1 in a partially disassembled state.

[0025] Fig. 17 is a cross-sectional view along the line 17-17 in Fig. 15 with the cap rotated about 45 degrees about the axis.

[0026] Fig. 18 is partial perspective view of the disassembled package showing a third embodiment of the present invention.

[0027] Fig. 19 is a partial view of the package of Fig. 18 where the cap is not fully closed on the body.

[0028] Fig. 20 is a partial view of the package of Fig. 18 where the cap is fully closed on the body.

[0029] Fig. 21 is a cross-sectional view of a fourth embodiment of the present invention.

[0030] Fig. 22 is a partial elevational view of the disassembled body of Fig. 21.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0031] As shown in Figs. 1, 2 and 3, the assembled package 10 comprises a cap 15 attached to a body 20. The package 10 can be made of any non-permeable or air permeable material depending on the characteristics of the product in the package. Preferably, for instant adhesives, the package 10 is made from a polyethylene or polypropylene resin. The cap 15 may have a plurality of grooves 16 and preferably the grooves 16 are equidistantly spaced and cover the entire length of the cap 15. The grooves 16 make the package 10 easier to grip and, therefore, easier to open and close. As shown in Fig. 4, the top of the cap 15 may have a molded in design. Figures 1 and 4 illustrate one possible design that consists of radially spaced blades 17 in a cylindrical recess 18. Fig. 14 illustrates another design that consists of a cylindrical recess 18 which contains in the center, a raised circular nub 19.

[0032] As shown in Figs. 5, 6, 7 and 8, the body 20 comprises at the upper end a tapered nozzle 25 where the adhesive is dispensed and at the lower end a chamber 35, having a top surface 34, where the adhesive is stored. The design of the nozzle 25 ensures good drain back of adhesive, when the package 10 is in an upright position. Therefore, the chances of adhesive remaining in the upper portion of the nozzle 25, crusting and eventually clogging the opening of the package is decreased. The nozzle 25 has a tip 30 with an orifice 24, and two superstructures: guide ribs 26 and a pair of guide flanges 27. A plurality of guide ribs 26 may be employed but, preferably, there are four equidistantly spaced ribs 26 parallel to the axis of the body. The ribs 26 aid in the proper placement of the cap 15 over the nozzle 25 and, at the same time, allow for a package design that has less surface contact between the nozzle 25 and the cap 15. This decreases the chances of having any stray adhesive that might have dripped down the outside of the nozzle 25 bonding the nozzle 25 to the cap 15.

[0033] The guide flanges 27 are located below the ribs 26, at the base of the nozzle 25. Each guide flange 27 has a horizontal lock member 28 and a vertical guide member 29 which is perpendicular to the horizontal lock member 28. The vertical guide member 29 has at its lower extremity a raised ramp portion 50 and also a guide surface 32, facing away from the horizontal lock member 28 and a stop surface 31, facing the horizontal lock member 28. The guide surface 32 is defined by the raised ramp portion 50 and the adjoining face of the vertical guide member 29. The stop surface 31 is defined by the opposite face of the vertical guide member 29. It is preferred to have two guide flanges 27 on the nozzle 25 spaced equidistantly on opposite sides of the nozzle 25.

[0034] As can be seen from Figs. 9 and 10, the cap 15 fits over the nozzle 25 and rests on top of the chamber 35. The exterior shape of the cap 15 mimics the shape of the nozzle 25, having a narrower top and broadening as it reaches the chamber 35. The break away portion of Figure 9 illustrates a plug 37 which comprises the bottom of the chamber 35. The plug 37 is designed to be snug-fitting and to prevent leakage. The body 20 may be a unibody, meaning it may be molded in one piece or a multibody as shown in Figure 22 where the plug 38 and the body 20 are molded separately and then attached.

[0035] The cap 15 has a structured, mainly hollow interior. The upper portion 21 of the interior of the cap 15 is preferably a cylindrical recess. The diameter of the upper portion 21 should be slightly larger than the diameter of the ribs 26 at their widest point, so that the cap 15 has a snug, non-interference fit with the guide ribs 26 of the nozzle 25. This is one part of ensuring that the cap 15 is tight fitting. The lower portion 22 of the cap 15 is preferably a tapered elliptical recess that follows the taper of the lower portion of the nozzle 25. The interior uppermost surface 23 of the cap 15 contains a pin 40 which protrudes from the uppermost surface 23 into the cylindrical recess of the upper portion 21 of the interior of the cap 15 and the pin 40 is oriented along the central axis of the package 10. The pin 40 is designed to fit snugly into the orifice 24 of the dispensing tip 30. The pin 40 keeps the adhesive from leaking out of the top of the package 10 when the package 10 is placed in a non-upright position. Also, the pin 40 serves a nonclogging function. When the cap 15 is on the body 20, the pin 40 is ensconced in the orifice 24 which discourages adhesive buildup at the tip 30 and each time the cap 15 is placed back on the body 20, the pin 40 will pierce through any adhesive that might have crusted in and around the orifice 24.

[0021] Fig. 13 is a partial cross-sectional view of the upper portion of a second embodiment of the present invention.

[0022] Fig. 14 is a top plan view of a package of Fig. 13.

[0023] Fig. 15 is a cross-sectional view of the package of Fig. 1 in a partially disassembled state.

[0024] Fig. 16 is a cross-sectional view of the package of Fig. 1 in a partially disassembled state.

[0025] Fig. 17 is a cross-sectional view along the line 17-17 in Fig. 15 with the cap rotated about 45 degrees about the axis.

[0026] Fig. 18 is partial perspective view of the disassembled package showing a third embodiment of the present invention.

[0027] Fig. 19 is a partial view of the package of Fig. 18 where the cap is not fully closed on the body.

[0028] Fig. 20 is a partial view of the package of Fig. 18 where the cap is fully closed on the body.

[0029] Fig. 21 is a cross-sectional view of a fourth embodiment of the present invention.

[0030] Fig. 22 is a partial elevational view of the disassembled body of Fig. 21.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0031] As shown in Figs. 1, 2 and 3, the assembled package 10 comprises a cap 15 attached to a body 20. The package 10 can be made of any non-permeable or air permeable material depending on the characteristics of the product in the package. Preferably, for instant adhesives, the package 10 is made from a polyethylene or polypropylene resin. The cap 15 may have a plurality of grooves 16 and preferably the grooves 16 are equidistantly spaced and cover the entire length of the cap 15. The grooves 16 make the package 10 easier to grip and, therefore, easier to open and close. As shown in Fig. 4, the top of the cap 15 may have a molded in design. Figures 1 and 4 illustrate one possible design that consists of radially spaced blades 17 in a cylindrical recess 18. Fig. 14 illustrates another design that consists of a cylindrical recess 18 which contains in the center, a raised circular nub 19.

[0032] As shown in Figs. 5, 6, 7 and 8, the body 20 comprises at the upper end a tapered nozzle 25 where the adhesive is dispensed and at the lower end a chamber 35, having a top surface 34, where the adhesive is stored. The design of the nozzle 25 ensures good drain back of adhesive, when the package 10 is in an upright position. Therefore, the chances of adhesive remaining in the upper portion of the nozzle 25, crusting and eventually clogging the opening of the package is decreased. The nozzle 25 has a tip 30 with an orifice 24, and two superstructures: guide ribs 26 and a pair of guide flanges 27. A plurality of guide ribs 26 may be employed but, preferably, there are four equidistantly spaced ribs 26 parallel to the axis of the body. The ribs 26 aid in the proper placement of the cap 15 over the nozzle 25 and, at the same time, allow for a package design that has less surface contact between the nozzle 25 and the cap 15. This decreases the chances of having any stray adhesive that might have dripped down the outside of the nozzle 25 bonding the nozzle 25 to the cap 15.

[0033] The guide flanges 27 are located below the ribs 26, at the base of the nozzle 25. Each guide flange 27 has a horizontal lock member 28 and a vertical guide member 29 which is perpendicular to the horizontal lock member 28. The vertical guide member 29 has at its lower extremity a raised ramp portion 50 and also a guide surface 32, facing away from the horizontal lock member 28 and a stop surface 31, facing the horizontal lock member 28. The guide surface 32 is defined by the raised ramp portion 50 and the adjoining face of the vertical guide member 29. The stop surface 31 is defined by the opposite face of the vertical guide member 29. It is preferred to have two guide flanges 27 on the nozzle 25 spaced equidistantly on opposite sides of the nozzle 25.

[0034] As can be seen from Figs. 9 and 10, the cap 15 fits over the nozzle 25 and rests on top of the chamber 35. The exterior shape of the cap 15 mimics the shape of the nozzle 25, having a narrower top and broadening as it reaches the chamber 35. The break away portion of Figure 9 illustrates a plug 37 which comprises the bottom of the chamber 35. The plug 37 is designed to be snug-fitting and to prevent leakage. The body 20 may be a unibody, meaning it may be molded in one piece or a multibody as shown in Figure 22 where the plug 38 and the body 20 are molded separately and then attached.

[0035] The cap 15 has a structured, mainly hollow interior. The upper portion 21 of the interior of the cap 15 is preferably a cylindrical recess. The diameter of the upper portion 21 should be slightly larger than the diameter of the ribs 26 at their widest point, so that the cap 15 has a snug, non-interference fit with the guide ribs 26 of the nozzle 25. This is one part of ensuring that the cap 15 is tight fitting. The lower portion 22 of the cap 15 is preferably a tapered elliptical recess that follows the taper of the lower portion of the nozzle 25. The interior uppermost surface 23 of the cap 15 contains a pin 40 which protrudes from the uppermost surface 23 into the cylindrical recess of the upper portion 21 of the interior of the cap 15 and the pin 40 is oriented along the central axis of the package 10. The pin 40 is designed to fit snugly into the orifice 24 of the dispensing tip 30. The pin 40 keeps the adhesive from leaking out of the top of the package 10 when the package 10 is placed in a non-upright position. Also, the pin 40 serves a nonclogging function. When the cap 15 is on the body 20, the pin 40 is ensconced in the orifice 24 which discourages adhesive buildup at the tip 30 and each time the cap 15 is placed back on the body 20, the pin 40 will pierce through any adhesive that might have crusted in and around the orifice 24.

ping feature will minimize the shearing forces, because of the high adherence strength of the cyanoacrylate adhesive and the concomitant force required to dislodge a pin 40 which has bonded to the orifice 24 due to stray adhesive. The type of pin 40 to be employed in package 10 therefore depends upon the contents of package 10. One skilled in the art can determine through simple experimentation what type of pin 40 should be used.

[0044] To close the package 10, the cap 15 is placed on the nozzle 25 so that the lower portion 60 of the band members 58 pass between the horizontal lock member 28 of one guide flange 27 and the vertical guide member 29 of the other guide flange 27. The cap 15 is then pushed down until the lower portion of the bands 60 meet the raised ramps 50 on the guide surfaces 32 of the vertical members 29. Fig. 15 illustrates the moment in time when the cap 15 is placed on the nozzle 25 and the guide ribs 26 first make contact with the interior surface of the upper portion 21 of the cap 15. The ribs 26 ensure the proper alignment of the cap 15 on the nozzle 25 so that the pin 40 fits directly into the orifice 24 of the nozzle 25 as shown in Fig. 16. Once the lower portion of the bands 60 touch the ramps 50, the cap 15 must be twisted along the axis of the body 20 to line up the bottom of the cap 15 with the top of the chamber 35. As the cap 15 is twisted into place, three things will happen. First, the pin 40 will penetrate the orifice 24 of the nozzle 25. Second, the horizontal lock members 28 of the guide flanges 29 will engage the slots 59 of the band members 58, locking the cap 15 onto the body 20 and third, the vertical edge 56 of both stopping members 55 will hit the stop surface 31 of both vertical guide members 29 preventing the cap 15 from over rotating or twisting any further.

[0045] The engagement of the slots 59 by the horizontal locking members 28 prevents a user from pulling the cap 15 straight off the nozzle 25 and subjecting the pin 40 to shearing forces. Instead, the cap 15 must first be twisted so that the horizontal locking member 28 is retracted off the slot 59, and the pin 40 is twisted in the orifice 24, before any upward pressure can be placed on the cap 15. The package design also prevents the cap 15 from inadvertently falling off the body 20.

[0046] In an alternate embodiment of the invention as shown in Figs. 18, 19, and 20, the top surface 34 of the chamber 35 may contain a plurality of retaining nibs 45 and an equal number of hollows 70 on the base of the cap 15. Preferably, there are two retaining nibs 45 positioned on opposite sides of the nozzle 25 on the top surface 34 of the chamber 35 and two corresponding hollows 70 on the cap 15. As the cap 15 is twisted back on to the body 20, the retaining nibs 45 are engaged by the hollows 70 providing a snap fit between the bottom of the cap 15 and the top surface 34 of the chamber 35. The hollows 70 and retaining nibs 45 are additional preferable components of the closure mechanism of the present invention.

[0047] Another embodiment of the present invention provides a dual walled chamber 36 as shown in Fig. 21. Fig. 22 illustrates a plug 38 designed for the dual walled chamber. This dual wall feature has several advantages. First, it provides more sealing surface between the body 20 and the plug 38. This helps to ensure a tight fitting bottom for the body 20 and thus decreases the chances of a leak. Secondly, the dual wall 36 provides an additional barrier between the ambient air and the contents of the package 10. This is important when the ambient conditions are such that they will adversely affect the contents of the package 10, for example when the air contains a lot of moisture and the package 10 contains adhesive. Also, the dual wall design gives the chamber 36 of the package 10, more flexibility so that less pressure needs to be applied to dispense from the package 10.

[0048] Obviously, other modifications and variations to the present invention are possible and may be apparent to those skilled in the art in light of the above teachings. For example, this invention may be applied to containers and container closures having a circular, as opposed to an elliptical, cross-section. In such instances, the orientation of the guide flanges, rectangular bands, and rectangular stopping members may be different. For instance, a circular cross-section would allow for a greater turning radius between full closure and opening. However, the turning radius would still be less than 180° and preferably less than about 90°. Obviously, the turning radius would also depend upon the number of guide flanges, band members, and stopping members to be employed since the maximum turning radius decreases with the larger number of such features. Another alternative may be where the band member and the stopping member are one rather than two separate elements. Thus, it is to be understood that such modifications and variations to the specific embodiments set forth above, are to be construed as being within the full intended scope of the present invention as defined by the appended claims.

Claims

1. A package (10), for storing and dispensing liquids, which comprises a body (20) comprising an elongate nozzle (25) with an orifice (24) and a base, and a chamber (35) having a top surface (34) from which the nozzle extends, a cap (15) which fits snugly over the nozzle, the cap also having an interior pin (40) which fits into the orifice of the nozzle, keeping the nozzle from clogging, the cap and the nozzle extending along a common elongate axis, comprising a closure mechanism with:

   (a) at least one guide flange (27) located at a base of the nozzle extending outwardly therefrom, the flange further comprising a lock member (28) parallel to the base of the nozzle and

a guide member (29) perpendicular to the base of the nozzle wherein the guide member is perpendicular to the lock member, the guide member having a raised ramp member (50) extending from its lower extremity, a guide surface (32) defined by the raised ramp member and an adjoining face of the guide member, and a stop surface (31) defined by an opposite face of the guide member; whereby the lock member (28) extends from the stop surface (31);
(b) the cap having a lower portion (22) with a first recess extending therethrough and an upper portion (21) with a second recess extending therethrough, the first having a larger diameter than the second recess;
(c) at least one stopping member (55) in the lower portion of an interior of the cap, the stopping member extending throughout the lower portion, further comprising an edge (56) parallel to the elongate axis of the cap which extends along the entire length of the stopping member, the stopping member located in a configuration such that when the cap is placed in a fully closed position on the body, the edge abuts the stop surface of the guide member (29) preventing the cap from over rotating on the body; and
(d) at least one longitudinal band member (58) extending axially in the lower portion of the interior of the cap, the band member further comprising a transverse slot (59) dividing the band member into an upper portion (61) and a lower portion (60), the slot located at about the same height as the lock member (28) when the cap is placed in a fully closed position on the body (20) and the slot (59) having a width slightly larger than the width of the lock member (28) of the guide flange such that when the cap is placed in the fully closed position, the lock member (28) extends through the slot (59) the lower portion of the band member (60) extending from an end of the slot to a bottom of the cap;

such that to open the package, the cap is twisted about the longitudinal axis of the package, retracting the locking member (28) from the slot (59), until the lower portion of the band member (60) touches and travels up the ramp member and the guide surface of the guide member (29), disengaging the pin (40) from the orifice (24) and causing the removal of the cap from the body.

2. The package as claimed in claim 1 **characterised in that** the lower portion (22) of the cap and the top surface of the chamber (34) have an elliptical cross section with a major and minor axis, the band member (58) located on the minor axis and the stopping member (55) located around the major axis in a configuration such that when the cap is placed in a fully closed position on the body, the edge (56) of the stopping member (55) abuts the stop surface (31) of the guide member (29).

3. The package as claimed in claim 1 or 2 **characterised in that** the closure mechanism further comprises two equidistantly spaced retaining nibs (45) on opposite sides of the top surface of the chamber and two corresponding hollows (70) in a base of the cap, such that when the cap is placed in the fully closed position on the body, the hollows engage the retaining nibs.

4. The package as claimed in any of claims 1 to 3 **characterised in that** the nozzle further comprises a plurality of guide ribs (26) equidistantly spaced around the nozzle, parallel to the axis of the package and located above the guide flange (27), the diameter of the guide ribs at their widest point slightly less than the diameter of the upper interior portion of the cap to that when the cap is in a fully closed position, there is a snug, non-interference fit between the cap and the nozzle.

5. The package as claimed in any of claims 1 to 4 **characterised in that** the closure mechanism comprises:

(a) a pair of guide flanges (27) equidistantly spaced on opposite sides of the nozzle (25);
(b) a pair of stopping members (55); and
(c) a pair of equidistantly spaced band members (58).

6. The package as claimed in claim 5 **characterised in that** the lower portion of the cap (24) and the top surface of the chamber (34) have an elliptical cross section with a major and minor axis, the guide flanges (27) located on opposite sides of the minor axis, the stopping members (55) located on opposite sides of the major axis, just above and below the major axis, such that when the cap is placed in a fully closed position on the body, the edges (56) of the stopping members (55) abut the stop surface (31) of the guide members (29), and the band members (58) are located on opposite ends of the minor axis.

7. The package as claimed in any of claims 1 to 6 **characterised in that** the chamber comprises dual walls (36).

8. The package as claimed in claim 7 **characterised in that** there are four equidistantly spaced guide ribs (26).

9. The package as claimed in any of claims 1 to 8 **char-**

acterised in that the package contains a curable material.

10. The package as claimed in claim 9 **characterised in that** the curable material is an adhesive.

11. The package as claimed in any of claims 1 to 8 **characterised in that** the package contains a hardenable material.

Patentansprüche

1. Verpackung (10) zur Aufbewahrung und Abgabe von Flüssigkeiten, die umfasst: einen Körper (20), der eine langgestreckte Düse (25) mit einer Öffnung (24) und einer Basis und eine Kammer (35) mit einer Oberseite (34), von der aus sich die Düse erstreckt, umfasst, eine Abdeckkappe (15), die satt über die Düse passt, wobei die Abdeckkappe auch einen inneren Stift (40) aufweist, der in die Öffnung der Düse passt, wobei er die Düse vom Verstopfen abhält, wobei sich die Abdeckkappe und die Düse entlang einer gemeinsamen langgestreckten Achse erstrecken, umfassend einen Verschlussmechanismus mit:

   (a) mindestens einem Führungsflansch (27), der an einer Basis der Düse angeordnet ist, wobei er sich davon nach außen erstreckt, wobei der Flansch weiter ein zur Basis der Düse paralleles Arretierelement (28) und ein zur Basis der Düse senkrechtes Führungselement (29) umfasst, wobei das Führungselement senkrecht zum Arretierelement angeordnet ist, wobei das Führungselement aufweist: ein erhöhtes Rampenelement (50), das sich von seinem unteren äußersten Ende erstreckt, eine Führungsoberfläche (32), die durch das erhöhte Rampenelement und eine benachbarte Fläche des Führungselements definiert ist, und eine Anschlagoberfläche (31), die durch eine entgegengesetzte Fläche des Führungselements definiert ist, wobei sich das Arretierelement (28) von der Anschlagoberfläche (31) erstreckt;
   (b) wobei die Abdeckkappe einen unteren Teil (22) mit einer sich durch ihn hindurch erstreckenden ersten Ausnehmung und einen oberen Teil (21) mit einer sich durch ihn hindurch erstreckenden zweiten Ausnehmung aufweist, wobei die erste einen größeren Durchmesser aufweist als die zweite Ausnehmung;
   (c) mindestens einem Stoppelement (55) im unteren Teil eines Inneren der Abdeckkappe, wobei sich das Stoppelement im ganzen unteren Teil erstreckt, weiter umfassend eine zur langgestreckten Achse der Abdeckkappe parallele Kante (56), die sich entlang der ganzen Länge des Stoppelements erstreckt, wobei das Stoppelement in einer Konfiguration angeordnet ist, so dass, wenn die Abdeckkappe in einer vollständig verschlossen Position auf dem Körper angeordnet ist, die Kante gegen die Anschlagoberfläche des Führungselements (29) anliegt, wodurch eine übermäßige Drehung der Abdeckkappe auf dem Körper verhindert wird; und
   (d) mindestens einem Längsstreifenelement (58), das sich im unteren Teil des Inneren der Abdeckkappe axial erstreckt, wobei das Streifenelement weiter einen Querschlitz (59) umfasst, der das Streifenelement in einen oberen Teil (61) und einen unteren Teil (60) aufteilt, wobei der Schlitz an etwa derselben Höhe wie das Arretierelement (28) angeordnet ist, wenn die Abdeckkappe in einer vollständig verschlossen Position auf dem Körper (20) angeordnet ist, und wobei der Schlitz (59) eine Breite aufweist, die geringfügig größer ist als die Breite des Arretierelements (28) des Führungsflansches, so dass sich, wenn die Abdeckkappe in der vollständig verschlossen Position angeordnet ist, das Arretierelement (28) durch den Schlitz (59) erstreckt, wobei sich der untere Teil des Streifenelements (60) von einem Ende des Schlitzes zu einem Boden der Abdeckkappe erstreckt;

   so dass, um die Verpackung zu öffnen, die Abdeckkappe um die Längsachse der Verpackung gedreht wird, wobei das Arretierelement (28) aus dem Schlitz (59) zurückgezogen wird, bis der untere Teil des Streifenelements (60) das Rampenelement und die Führungsoberfläche des Führungselements (29) berührt und sich diese hinaufbewegt, wobei der Stift (40) aus dem Eingriff mit der Öffnung (24) gelöst und die Entfernung der Abdeckkappe vom Körper hervorgerufen wird.

2. Verpackung nach Anspruch 1, **dadurch gekennzeichnet, dass** der untere Teil (22) der Abdeckkappe und die Oberseite der Kammer (34) einen elliptischen Querschnitt mit einer Haupt- und Nebenachse aufweisen, wobei das Streifenelement (58) auf der Nebenachse angeordnet ist und das Stoppelement (55) in der Nähe der Hauptachse angeordnet ist, in einer Konfiguration, so dass, wenn die Abdeckkappe in einer vollständig verschlossenen Position auf dem Körper angeordnet ist, die Kante (56) des Stoppelements (55) gegen die Anschlagoberfläche (31) des Führungselements (29) anliegt.

3. Verpackung nach Anspruch 1 oder 2, **dadurch gekennzeichnet, dass** der Verschlussmechanismus weiter zwei in gleichem Abstand angeordnete Haltestückchen (45) auf entgegengesetzten Seiten der

Oberseite der Kammer und zwei entsprechende Aussparungen (70) in einer Basis der Abdeckkappe umfasst, so dass, wenn die Abdeckkappe in der vollständig verschlossen Position auf dem Körper angeordnet ist, die Aussparungen mit den Haltestückchen in Eingriff stehen.

4. Verpackung nach einem der Ansprüche 1 bis 3, **dadurch gekennzeichnet, dass** die Düse weiter eine Mehrzahl von in gleichem Abstand um die Düse herum angeordneten Führungsrippen (26) umfasst, die parallel zur Achse der Verpackung sind und sich über dem Führungsflansch (27) befinden, wobei der Durchmesser der Führungsrippen an ihrer weitesten Stelle geringfügig kleiner ist als der Durchmesser des oberen inneren Teils der Abdeckkappe, so dass, wenn sich die Abdeckkappe in einer vollständig verschlossen Position befindet, ein Pass-, kein Presssitz, zwischen der Abdeckkappe und der Düse vorhanden ist.

5. Verpackung nach einem der Ansprüche 1 bis 4, **dadurch gekennzeichnet, dass** der Verschlussmechanismus umfasst:

   (a) ein Paar Führungsflansche (27), die in gleichem Abstand auf entgegengesetzten Seiten der Düse (25) angeordnet sind;
   (b) ein Paar Stoppelemente (55); und
   (c) ein Paar in gleichem Abstand angeordnete Streifenelemente (58).

6. Verpackung nach Anspruch 5, **dadurch gekennzeichnet, dass** der untere Teil der Abdeckkappe (24) und die Oberseite der Kammer (34) einen elliptischen Querschnitt mit einer Haupt- und Nebenachse aufweisen, wobei die Führungsflansche (27) auf entgegengesetzten Seiten der Nebenachse angeordnet sind, die Stoppelemente (55) auf entgegengesetzten Seiten der Hauptachse direkt über und unter der Hauptachse angeordnet sind, so dass, wenn die Abdeckkappe in einer vollständig verschlossenen Position auf dem Körper angeordnet ist, die Kanten (56) der Stoppelemente (55) gegen die Anschlagoberfläche (31) der Führungselemente (29) anliegen, und die Streifenelemente (58) an entgegengesetzten Enden der Nebenachse angeordnet sind.

7. Verpackung nach einem der Ansprüche 1 bis 6, **dadurch gekennzeichnet, dass** die Kammer Doppelwände (36) umfasst.

8. Verpackung nach Anspruch 7, **dadurch gekennzeichnet, dass** es vier in gleichem Abstand angeordnete Führungsrippen (26) gibt.

9. Verpackung nach einem der Ansprüche 1 bis 8, **dadurch gekennzeichnet, dass** die Verpackung ein vernetzungsfähiges Material enthält.

10. Verpackung nach Anspruch 9, **dadurch gekennzeichnet, dass** das vernetzungsfähige Material ein Haftmittel ist.

11. Verpackung nach einem der Ansprüche 1 bis 8, **dadurch gekennzeichnet, dass** die Verpackung ein härtbares Material enthält.

Revendications

1. Conditionnement (10), destiné à stocker et distribuer des liquides, qui comprend un corps (20) comprenant une buse allongée (25) avec un orifice (24) et une base, et une chambre (35) comportant une surface supérieure (34) à partir de laquelle la buse s'étend, un capuchon (15) qui s'adapte parfaitement sur la buse, le capuchon comportant également une broche intérieure (40) qui s'adapte dans l'orifice de la buse, empêchant la buse de s'obstruer, le capuchon et la buse s'étendant le long d'un axe allongé commun, comprenant un mécanisme de fermeture comportant :

   (a) au moins un rebord de guidage (27) situé au niveau d'une base de la buse s'étendant vers l'extérieur de celle-ci, le rebord comprenant en outre un élément de verrouillage (28) parallèle à la base de la buse et un élément de guidage (29) perpendiculaire à la base de la buse, où l'élément de guidage est perpendiculaire à l'élément de verrouillage, l'élément de guidage comportant un élément en pente surélevé (50) s'étendant à partir de son extrémité inférieure, une surface de guidage (32) définie par l'élément en pente surélevé et une face contiguë de l'élément de guidage, et une surface de butée (31) définie par une face opposée de l'élément de guidage, d'où il résulte que l'élément de verrouillage (28) s'étend à partir de la surface de butée (31),
   (b) le capuchon comportant une partie inférieure (22) avec un premier évidement s'étendant à travers celle-ci et une partie supérieure (21) avec un second évidement s'étendant à travers celle-ci, le premier évidement présentant un diamètre plus grand que le second évidement,
   (c) au moins un élément de butée (55) dans la partie inférieure de l'intérieur du capuchon, l'élément de butée s'étendant sur toute la partie inférieure, comprenant en outre un bord (56) parallèle à l'axe allongé du capuchon qui s'étend le long de la longueur entière de l'élément de butée, l'élément de butée étant situé dans une configuration de sorte que lorsque le

capuchon est placé dans une position complètement fermée sur le corps, le bord vient en butée contre la surface de butée de l'élément de guidage (29) en empêchant le capuchon de tourner davantage sur le corps, et
(d) au moins un élément de bande longitudinal (58) s'étendant axialement dans la partie inférieure de l'intérieur du capuchon, l'élément de bord comprenant en outre une fente transversale (59) divisant l'élément de bande en une partie supérieure (61) et une partie inférieure (60), la fente étant située à environ la même hauteur que l'élément de verrouillage (28) lorsque le capuchon est placé dans une position complètement fermée sur le corps (20) et la fente (59) présentant une largeur légèrement plus grande que la largeur de l'élément de verrouillage (28) du rebord de guidage de sorte que lorsque le capuchon est placé dans la position complètement fermée, l'élément de verrouillage (28) s'étend à travers la fente (59), la partie inférieure de l'élément de bande (60) s'étendant à partir d'une extrémité de la fente vers une partie inférieure du capuchon,

de sorte que pour ouvrir le conditionnement, le capuchon est tourné autour de l'axe longitudinal du conditionnement, en retirant l'élément de verrouillage (28) de la fente (59), jusqu'à ce que la partie inférieure de l'élément de bande (60) touche et se déplace vers le haut de l'élément en pente et de la surface de guidage de l'élément de guidage (29), en désolidarisant la broche (40) de l'orifice (24) et en provoquant l'enlèvement du capuchon du corps.

2. Conditionnement selon la revendication 1, **caractérisé en ce que** la partie inférieure (22) du capuchon et la surface supérieure de la chambre (34) présentent une section transversale elliptique comportant un grand axe et un petit axe, l'élément de bande (58) étant situé sur le petit axe et l'élément de butée (55) étant situé autour du grand axe suivant une configuration telle que lorsque le capuchon est placé dans une position complètement fermée sur le corps, le bord (56) de l'élément de butée (55) vient en butée contre la surface de butée (31) de l'élément de guidage (29).

3. Conditionnement selon la revendication 1 ou 2, **caractérisé en ce que** le mécanisme de fermeture comprend en outre deux tenons de retenue espacés de façon équidistante (45) sur des côtés opposés de la surface supérieure de la chambre et deux creux correspondants (70) dans une base du capuchon, de sorte que lorsque le capuchon est placé dans la position complètement fermée sur le corps, les creux viennent en prise avec les tenons de retenue.

4. Conditionnement selon l'une quelconque des revendications 1 à 3, **caractérisé en ce que** la buse comprend en outre une pluralité de nervures de guidage (26) espacées de façon équidistante autour de la buse, parallèles à l'axe du conditionnement et situées au-dessus du rebord de guidage (27), le diamètre des nervures de guidage au niveau de leur point le plus large étant légèrement inférieur au diamètre de la partie intérieure supérieure du capuchon de sorte que lorsque le capuchon se trouve dans une position complètement fermée, il existe un ajustement parfait, non serré entre le capuchon et la buse.

5. Conditionnement selon l'une quelconque des revendications 1 à 4, **caractérisé en ce que** le mécanisme de fermeture comprend :

(a) une paire de rebords de guidage (27) espacés de façon équidistante sur les côtés opposés de la buse (25),
(b) une paire d'éléments de butée (55), et
(c) une paire d'éléments de bande espacés de façon équidistante (58).

6. Conditionnement selon la revendication 5, **caractérisé en ce que** la partie inférieure du capuchon (24) et la partie supérieure de la chambre (34) comportent une section transversale elliptique comportant un grand axe et un petit axe, les rebords de guidage (27) étant situés sur des côtés opposés du petit axe, les éléments de butée (55) étant situés sur les côtés opposés du grand axe, juste au-dessus et en dessous du grand axe, de sorte que lorsque le capuchon est placé dans une position complètement fermée sur le corps, les bords (56) des éléments de butée (55) viennent en butée contre la surface de butée (31) des éléments de guidage (29), et les éléments de bande (58) sont situés sur les extrémités opposés du petit axe.

7. Conditionnement selon l'une quelconque des revendications 1 à 6, **caractérisé en ce que** la chambre comprend des parois doubles (36).

8. Conditionnement selon la revendication 7 **caractérisé en ce qu'**il existe quatre nervures de guidage espacées de façon équidistante (26).

9. Conditionnement selon l'une quelconque des revendications 1 à 8 **caractérisé en ce que** le conditionnement contient un matériau polymérisable.

10. Conditionnement selon la revendication 9 **caractérisé en ce que** le matériau polymérisable est un adhésif.

11. Conditionnement selon l'une quelconque des re-

vendications 1 à 8 **caractérisé en ce que** le conditionnement contient un matériau durcissable.

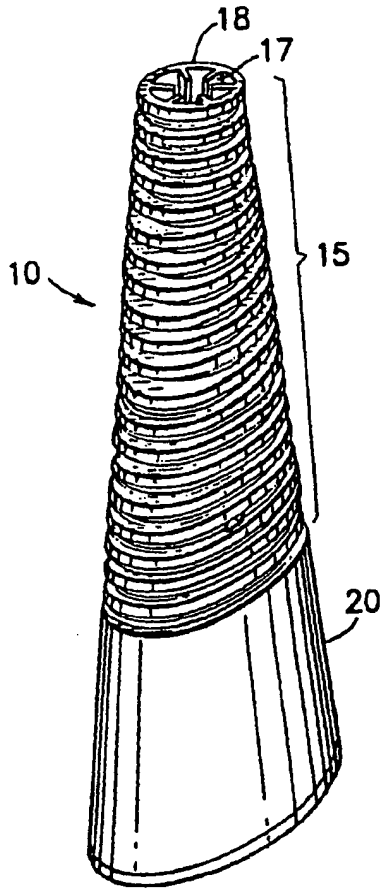

FIG. 1

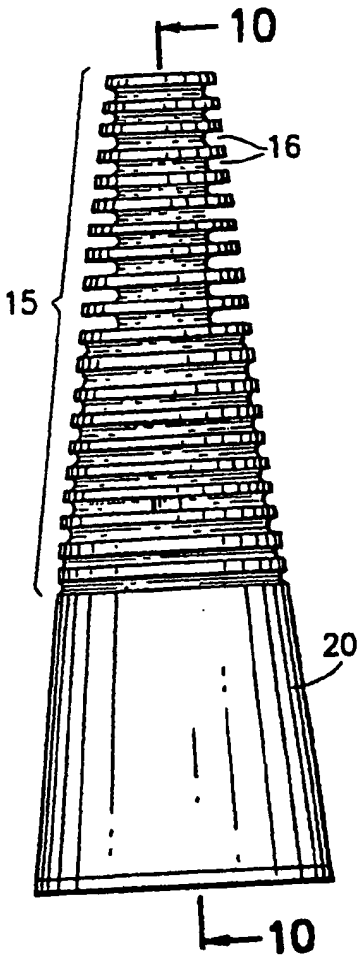

FIG. 2

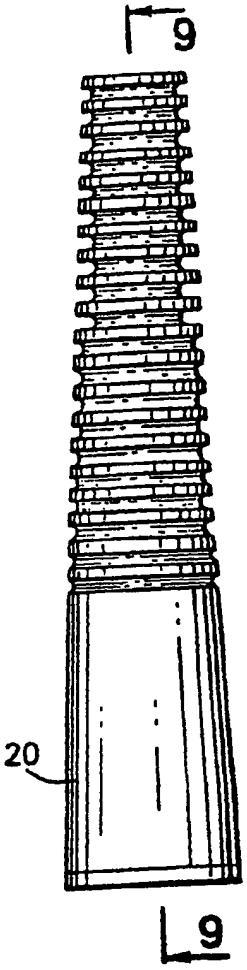

FIG. 3

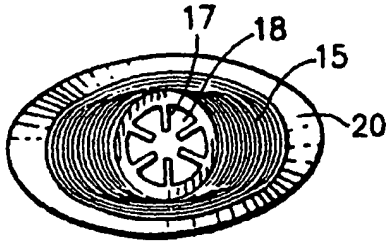

FIG. 4

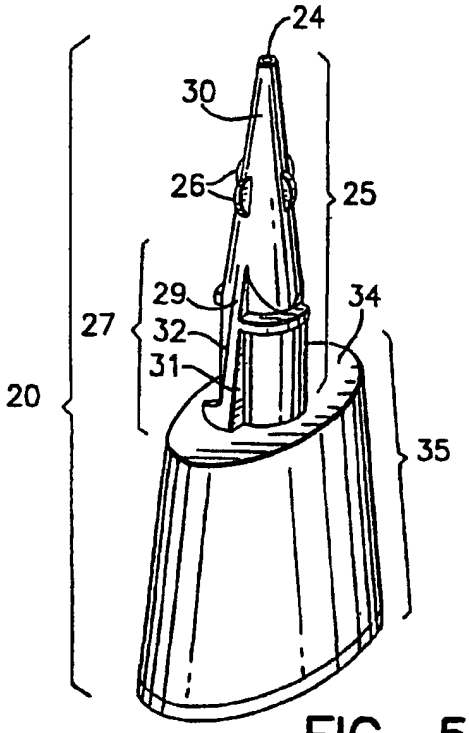

FIG. 5

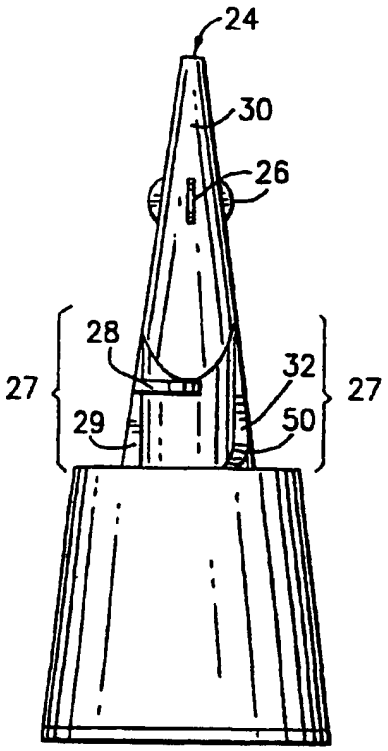

FIG. 6

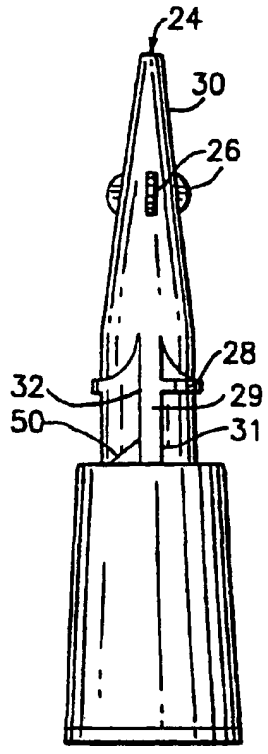

FIG. 7

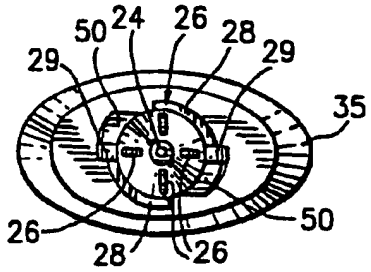

FIG. 8

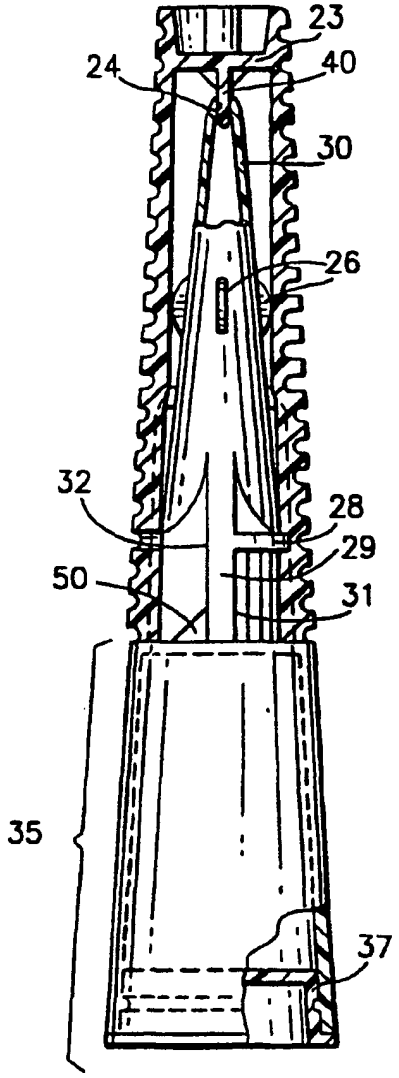

FIG. 9

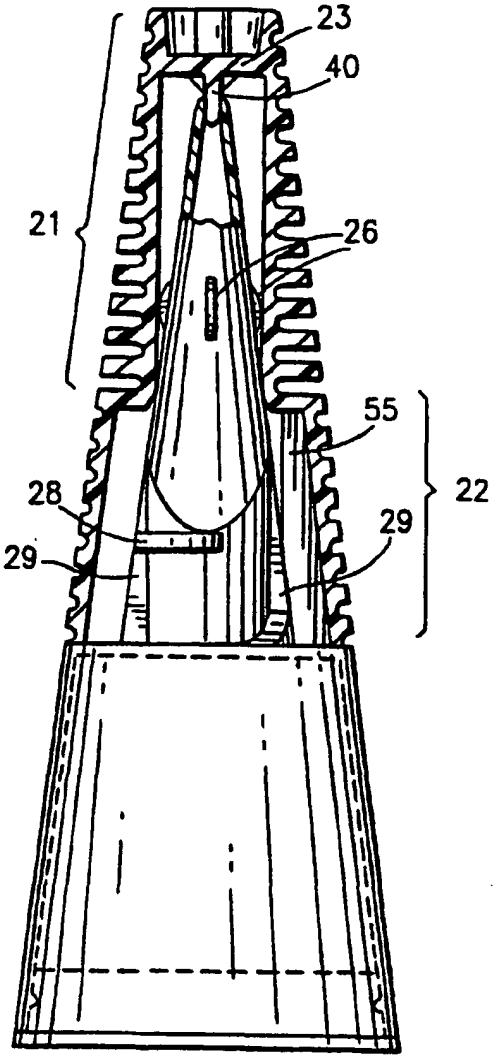

FIG. 10

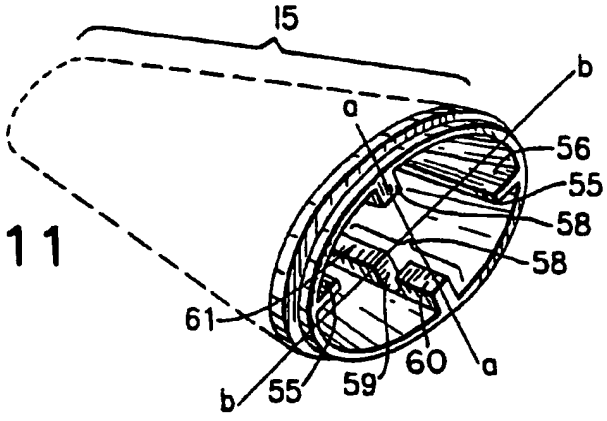

FIG. 11

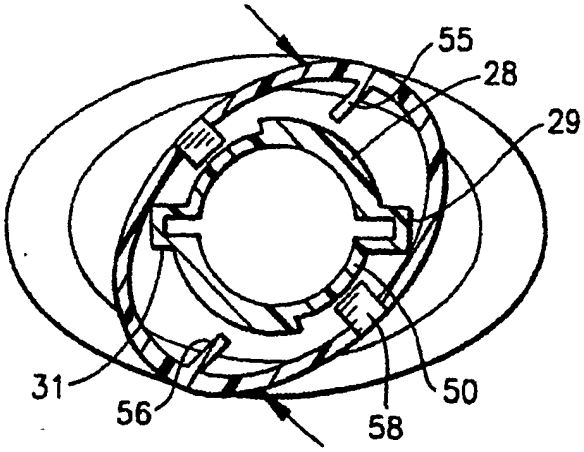

FIG. 17

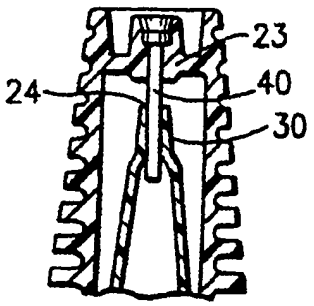

FIG. 13

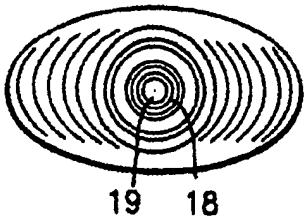

FIG. 14

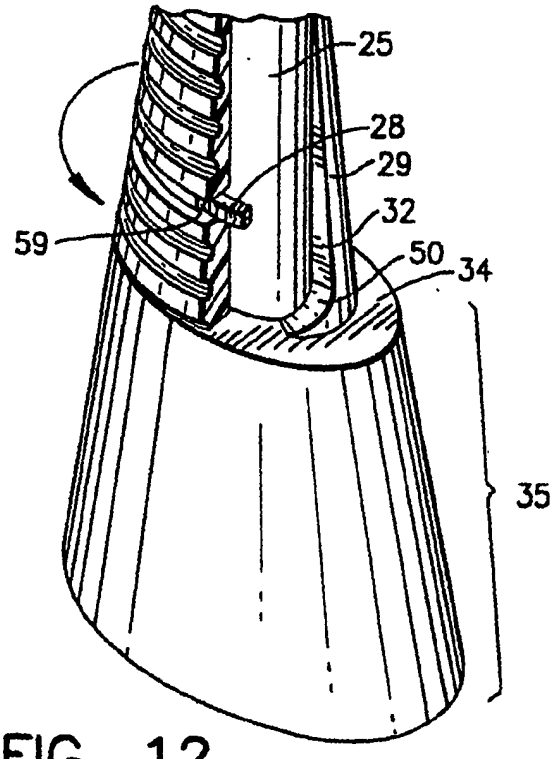

FIG. 12

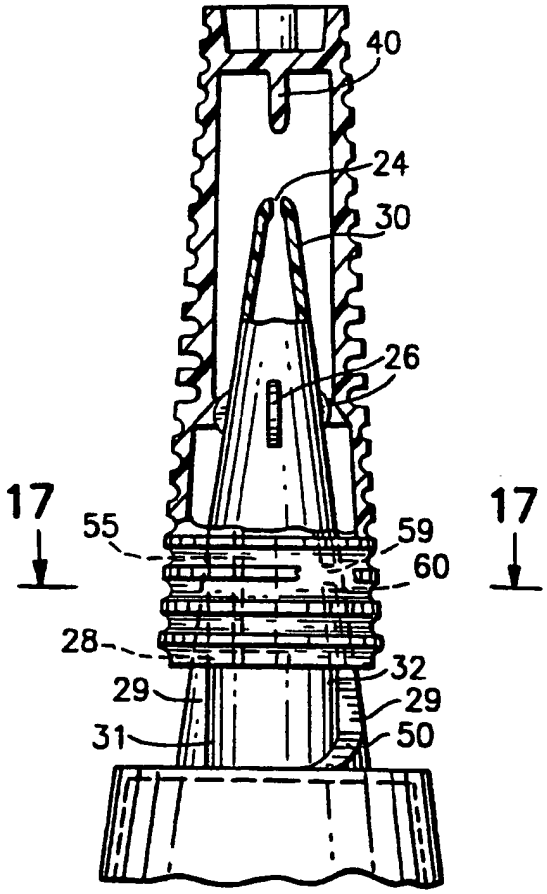

FIG. 15

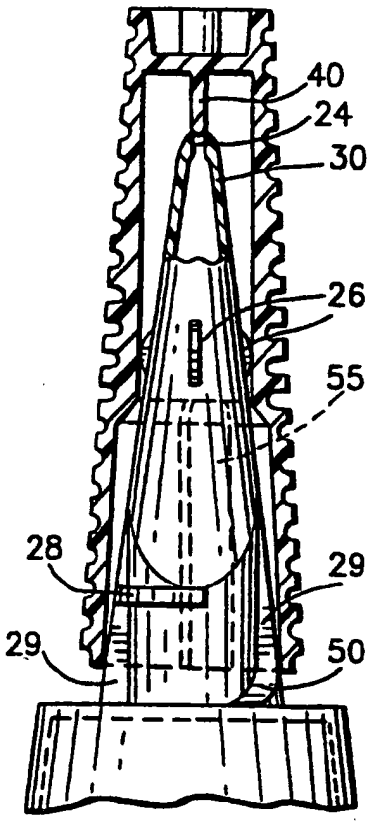

FIG. 16

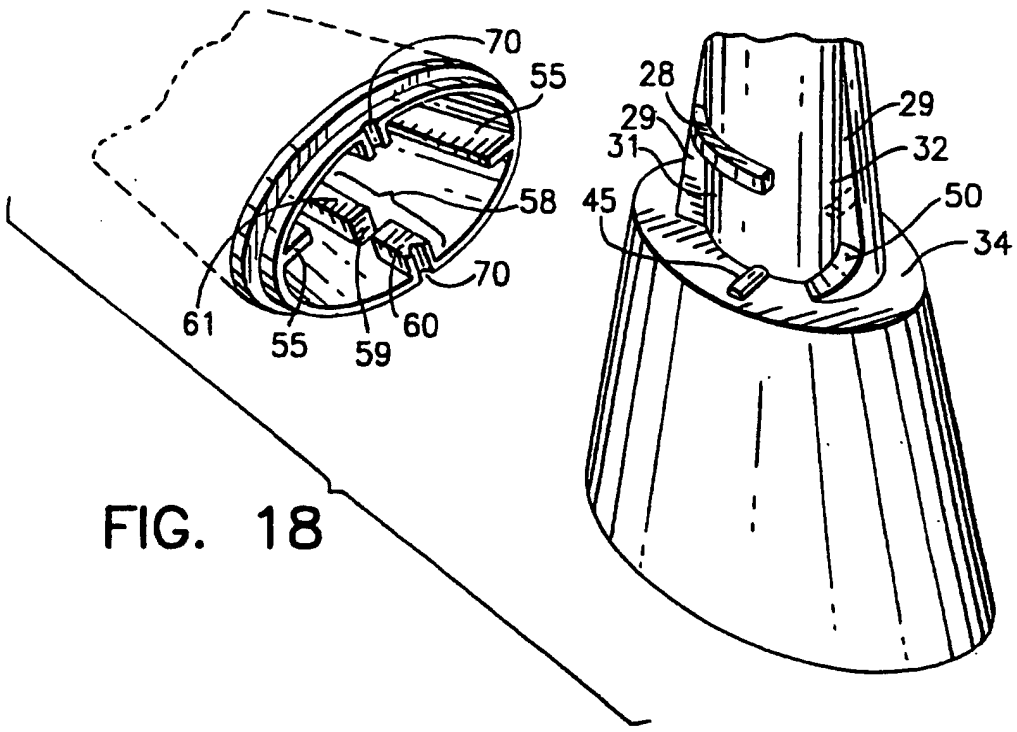

FIG. 18

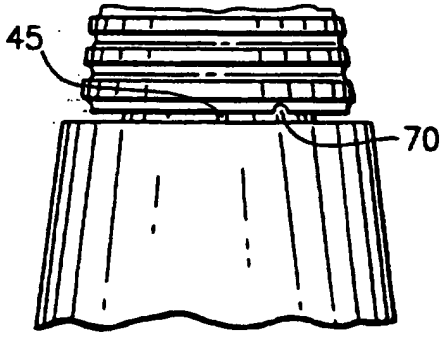

FIG. 19

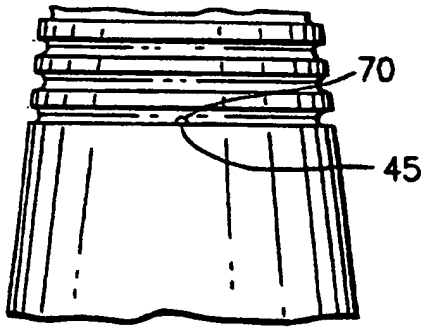

FIG. 20

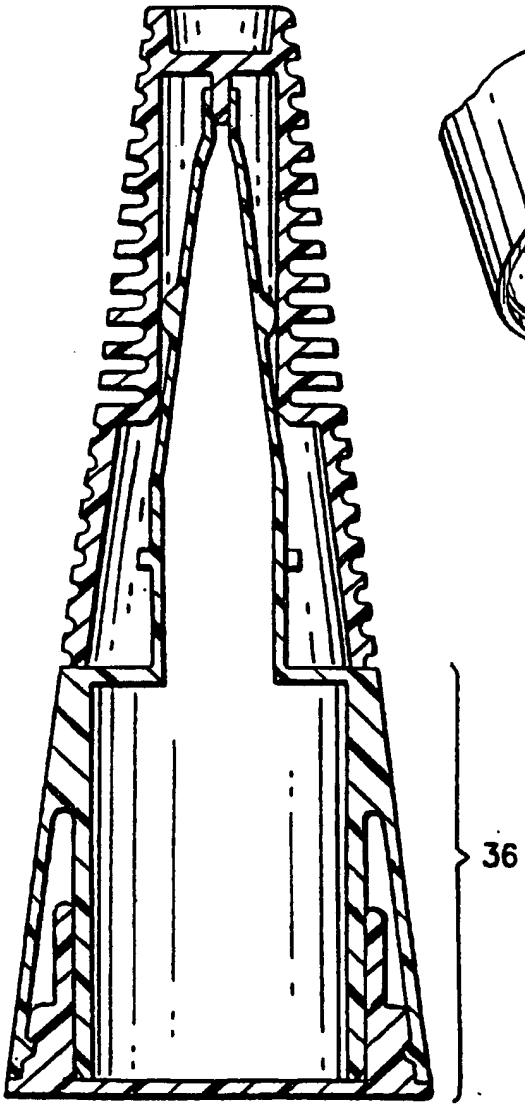

FIG. 21

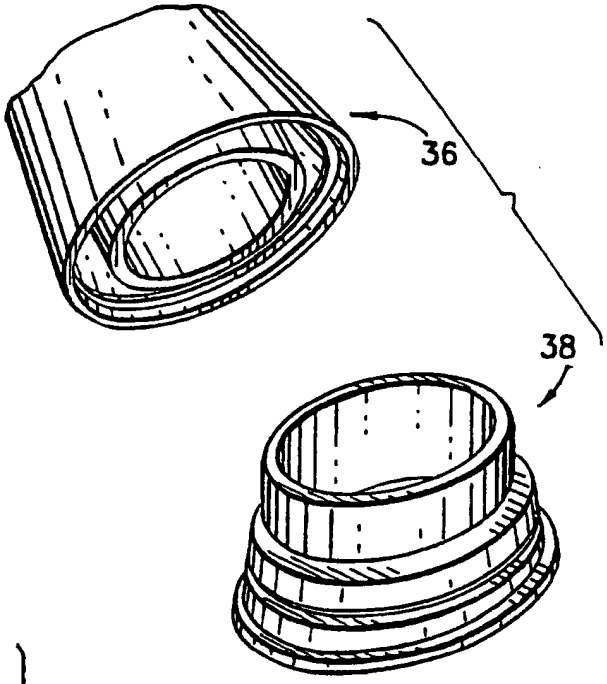

FIG. 22

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(54) Dental cartridge having an attachable delivery portion

(57) A dental cartridge or capsule for dispensing a dental material, such as an amalgam, cement, or glass ionomer. A body portion has a reduced diameter end. A frangible seal is placed adjacent or within the reduced diameter end. A delivery portion or cap has a metal cannula extending there through. The delivery portion or cap is snap fit onto the reduced diameter end. The metal cannula is positioned within the delivery portion or cap so as to rupture the frangible seal in the reduced diameter end of the body portion when the delivery portion or cap is snap fit onto the reduced diameter end. A material placed within the body portion of the dental cartridge is sealed within the body portion, and prevented from entering and thereby possibly clogging the delivery portion of the dental cartridge having a relatively small diameter bore or lumen prior to placement of the delivery portion or cap. In another embodiment the frangible seal is formed by a twist-off tab at the end of the reduced diameter portion. The mixing of a first component, typically a powder, and a liquid component of a dental material is greatly facilitated.

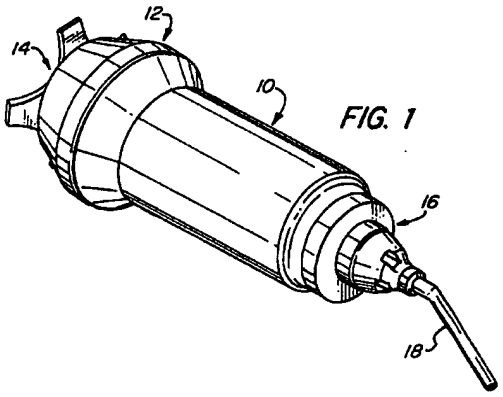

FIG. 1

EP 0 919 206 A2

Description

FIELD OF THE INVENTION

[0001] The present invention relates generally to a dental cartridge used to deliver dental material, and particularly to a cartridge having a delivery portion with a cannula that attaches to the front of the cartridge.

BACKGROUND OF THE INVENTION

[0002] In dentistry, it is common to dispense different dental materials with a cartridge used in combination with a syringe. In many applications, the dental material is required to be mixed within the cartridge, such as in the use of amalgam, cement, or glass ionomer materials. Some dental capsules may come prepackaged or premixed. Additionally, some capsules are not able to be dispensed from the capsule directly. Many prepackaged capsules are limited in the volume of material that can be mixed because of the limited amount of component materials that are prepackaged, such as a volume of liquid. A first component of a material is usually placed within a cartridge or capsule and mixed with a liquid component in a mechanical mixer, such as an amalgamator, prior to dispensing. While mixing these dental materials, it is required to keep the first component, which is typically a powder, from entering the delivery portion of the cartridge or capsule. The delivery portion is usually a reduced diameter cannula having a lumen or small bore therein. Problems often occur in that an unmixed portion of the first component will inadvertently enter the lumen and cause blockage. This prevents dispensing of the mixed dental material contained within the body of the cartridge. Material and time is often wasted in that the defective cartridge must be thrown away, and the process of mixing the dental material started over. This is inconvenient in that the patient must typically wait, after being prepared for application of the dental material, until the dentist can prepare another cartridge of dental material. Additionally, the dentist looses valuable productive time. Various methods have been used in an attempt to prevent unintentional blockage of the lumen with dental material before being mixed. Such solutions have been in the form of pins inserted within the lumen to prevent material unintentionally entering the lumen, and seals placed between the lumen and the interior body portion of a cartridge. However, these methods are often inconvenient to use and not completely reliable. One such cartridge is disclosed in United States Patent 5,172,807 entitled "Cement Mixing Capsule" and issuing to Dragan et al on December 22, 1992, which is herein incorporated by reference. Therein disclosed is a dental cartridge or capsule having a frangible seal placed between a nozzle and the body portion of the capsule to prevent unmixed cement from entering the nozzle. Another cartridge and dental syringe is disclosed in United States Patent 5,306,147 entitled "Dental Syringe and Cartridge Therefor" issuing to Dragan et al on April 26, 1994, which is herein incorporated by reference. While these prior devices and methods have proven useful, there is a need for a more reliable and easily manufactured dental cartridge for use with dental materials requiring mixing or requiring to be temporally separated from a cannula used for dispensing or applying the dental material.

SUMMARY OF THE INVENTION

[0003] The present invention is a dental cartridge for dispensing a dental material with a delivery portion having a cannula that snaps onto a reduced diameter end of the cartridge. A frangible seal is placed adjacent or within the reduced diameter end of the cartridge separating the reduced diameter end from the larger body portion of the cartridge. A delivery portion or cap having a cannula fixed therein snaps onto the reduced diameter portion. The cannula extends sufficiently far to enter the reduced diameter portion of the cartridge and puncture the frangible seal therein. In another embodiment a twist-off tab is used as a frangible seal. In one embodiment, the delivery portion or cap is securely held onto the reduced diameter end of the cartridge by a snap fit locking mechanism. Flow between the body portion of the cartridge and the cannula in the delivery portion or cap is thereby securely established. A plug having flexible ears or handles thereon is inserted into the back end of the cartridge to force the material out of the cartridge and through the lumen of the cannula for application of the mixed dental material to the patient. The plug may be advanced by any convenient dispensing device, such as a syringe or other mechanical applicator.

[0004] Accordingly, it is an object of the present invention to provide a cartridge with a seal that will break or rupture only when intended.

[0005] It is a further object of the present invention to permit mixing of a dental material without unintentionally blocking or clogging the delivery end of the cartridge or cannula.

[0006] It is an advantage of the present invention that a metal cannula may be used permitting bending to facilitate placement of the dental material.

[0007] It is a further advantage of the present invention that the dentist may select different sized cannulas to be used in combination with a single dental cartridge.

[0008] It is a feature of the present invention that the dispensing cannula is used to break a frangible seal.

[0009] It is another feature of the present invention that a twist-off tab provides a frangible seal.

[0010] It is a further feature of the present invention that the plug or piston used with the cartridge has flexible ears for grasping.

[0011] It is a further feature of an embodiment of the present invention that the delivery portion or cap snaps onto a reduced diameter end of the cartridge body.

[0012] These and other objects, advantages, and features will become readily apparent in view of the following more detailed description.

BRIEF DESCRIPTION OF THE DRAWINGS

[0013]

Fig. 1 is a perspective view of an embodiment of the present invention.
Fig. 2 is a perspective view of a plug.
Fig. 3 is a perspective view of a delivery portion or cap.
Fig. 4 is a partial cross section and exploded view of a front portion of the present invention.
Fig. 5 is a cross section taken along line 5-5 in Fig. 4.
Fig. 6 is a longitudinal cross section of an embodiment of the present invention.
Fig. 7 is a cross section of a portion of an embodiment of the present invention.
Fig. 8 is a cross section taken along line 8-8 in Fig. 7.
Fig. 9 schematically illustrates another embodiment of the present invention without a delivery portion placed thereon.
Fig. 10 schematically illustrates the embodiment illustrated in Fig. 9 with a delivery portion placed thereon.
Fig. 11 is a perspective view illustrating another embodiment.
Fig. 12 is a partial cross section of the embodiment illustrated in Fig. 11.
Fig. 13 is a partial side view illustrating the front portion of another embodiment of the present invention.
Fig. 14 is a front view of the embodiment illustrated in Fig. 13.
Fig. 15 is a partial side view illustrating the front portion of the embodiment illustrated in Figs. 13 and 14 adapted to receive a threaded delivery portion.
Fig. 16 is a partial side view illustrating the front portion of the embodiment illustrated in Figs. 13 and 14 adapted to receive a delivery portion having a flange.
Fig. 17 is a partial side view illustrating the front portion of another embodiment of the present invention.
Fig. 18 is a partial cross section illustrating the embodiment illustrated in Fig. 17 with a delivery portion attached.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0014] Fig. 1 generally illustrates an embodiment of the present invention. A dental cartridge is comprised of a body 10 having a holding or collar end portion 12 and a delivery portion or cap 16. The dental cartridge may be made of any suitable material, for example plastic. Held within delivery portion or cap 16 is tube or cannula 18. The cannula 18 may be held with friction or sealed or glued in place. Sealing the larger diameter open end of body 10 is a piston or plug 14. Typically, material is placed within the body 10 of the cartridge and mixed prior to placement of the delivery portion or cap 16 on the other end of the body 10. The material, which is preferably dental material, is then dispensed through the cannula 18. The cannula 18 is preferably made from metal that is easily bent, but may be made from any material.

[0015] Fig. 2 more clearly illustrates the piston or plug 14 illustrated in Fig. 1. The piston or plug 14 is comprised of a generally cylindrical body having handles or ears 20 formed on one end. The handles or ears 20 are flexible and facilitate grasping or holding of the plug 14 for insertion and removal permitting easy filling of the cartridge with material. The handles or ears 20 extend radially beyond the generally cylindrical body of the plug 14. Additionally, the ears 20, being flexible, bend backwards and do not interfere with the advancing motion of the plug 14 when pushed through the body 10 of the cartridge by a syringe or other mechanical applicator, not shown. The plug 14 also has a front wipe 22 and a rear wipe 24 with an intermediate portion 26 therebetween.

[0016] Fig. 3 more clearly illustrates the delivery portion or cap 16 illustrated in Fig. 1. However, Fig. 3 illustrates the delivery portion or cap without the cannula 18 inserted. The interior space of delivery portion or cap 16 has a plurality of ramps 30 equidistantly spaced therein. A flange 28 provides a grasping area to facilitate pushing the delivery portion or cap 16 onto the cartridge body 10. The reduced cap portion 32 is sized to retain the cannula 18, shown in Fig. 1.

[0017] Fig. 4 more clearly illustrates the front end portion of the cartridge. The cartridge body 10 has a reduced diameter portion 38 with a locking means formed thereon. The locking means may have any structure capable of locking or firmly holding on to a delivery portion or cap 16. By way of example, the locking means comprises an angled surface 34 and an exterior shoulder 36. The delivery portion or cap 16 has ramps 30 therein that have an interior shoulder 33 that is adapted to mate with exterior shoulder 36. Preferably, there are four ramps 30 equally spaced around the inside diameter of the delivery portion or cap 16. Cap or delivery portion 16 has a flange 28 thereon. The flange 28 facilitates holding of the delivery portion or cap 16 and placement onto the cartridge body 10. One end of the cap 16 has a reduced diameter cap portion 32. The reduced diameter cap portion 32 has a bore 44 therein. The bore 44 is sized to frictionally receive and hold securely the cannula 18. Cannula 18 may be made of any material, but is preferably made of a bendable metal material, such as a soft stainless steel. Openings or

vents 42 are placed within the delivery portion or cap 16 and help to prevent entrapping air upon placement of the cap 16 onto the cartridge body 10. Additionally, openings 42 are helpful in the molding process. A frangible diaphragm 40 seals the opening within the reduced portion 38. The frangible diaphragm 40 prevents dental material 60 from being dispensed from the cartridge until the frangible diaphragm 40 is ruptured. After preparation or mixing of the dental material 60 contained within the body 10 of the cartridge, the delivery portion or cap 16 is moved in the direction of arrows 46 to become locked with a snap fit onto the end of the body 10. The ramps 30 are caused to slide over the angled surface 34 and when fully positioned, the internal shoulder 33 mates with the external shoulder 36, securely holding the delivery portion or cap 16 onto the reduced diameter portion 38 of the body 10. A portion of the cannula 18 extends within the interior of the delivery portion or cap 16 sufficiently far so as to strike the frangible diaphragm 40, causing it to rupture. The end of the cannula 18 then extends into the body 10 of the cartridge, permitting the prepared dental material 60 to flow therein. Angled surface 34 seals the opening 42.

[0018] Fig. 5 is a cross section taken along line 5-5 in Fig. 4. Fig. 5 more clearly illustrates an embodiment of the diaphragm 40. Diaphragm 40 comprises a thin wall or seal which effectively prevents dental material from escaping or traveling out of the cartridge body. Scored or reduced thickness sections 48 help to provide a weakened portion for more easily rupturing the frangible diaphragm 40 with the cannula. The scored or reduced thickness sections 48 circumscribe the frangible diaphragm 40, with the diaphragm 40 comprised of two sections. Each section is attached to the reduced diameter portion 38 by a hinge 50. The hinges 50 prevent the frangible diaphragm 40 from breaking free and mixing with the dental material contained within the body of the cartridge. While this embodiment is illustrated with two sections, clearly any number of sections may be provided.

[0019] Fig. 6 illustrates an embodiment of the present invention in assembled form. The end portion or holding collar 12 has a front shoulder 52 and a rear shoulder 54 forming a groove or channel 64. Typically, a holding device is placed within the groove channel 64 to hold the cartridge body 10 in position while a plunger, not shown, is advanced to contact the back of the plug or piston 14. For example, the cartridge body 10 may be placed in a syringe or applicator device such as that disclosed in U.S. Patent 5,306,147 entitled "Dental Syringe and Cartridge Therefor", which is herein incorporated by reference. The plug or piston 14 is advanced in the direction of arrow 66 so as to extrude the material 60 contained within the body 10 of the cartridge. A vent 15 is placed in a portion of the body 10 so that air is permitted to escape as the plug or piston 14 is advanced into the body 10. Alternately, the vent may be molded into the plug or piston 14. The delivery portion or cap 16 being snapped into position on the front reduced diameter portion 38 of the body 10 is securely held in position by the mating shoulders 33 and 36 of the ramps 30 and angled surface 34. The end of the cannula 18, placed within the delivery portion or cap 16 has a sufficient length to break or pierce the frangible diaphragm 40. Accordingly, by placement of the delivery portion or cap 16 on the reduced diameter portion 38 of the cartridge body 10, the breaking or rupturing of the frangible diaphragm 40 is assured. As the plug or piston 14 is advanced, dental material 60 is extruded through the bore or lumen 56 of the cannula 18, to be delivered, typically into a patient's prepared tooth. The front surface 58 of the plug 14 may be formed to compliment the front body surface 62. In this way, nearly all of the dental material 60 contained within the cartridge is extruded, resulting in very little waste.

[0020] Fig. 7 illustrates another embodiment of the present invention. In Fig. 7, only a portion of the body 110 is illustrated for convenience. The reduced diameter portion 138 has a frangible diaphragm or seal 140 therein. The front portion of the reduced diameter portion 138 has an exterior angled surface 134 and an interior angled surface 135. The interior angled surface 135 facilitates and guides the placement of the cannula 118. Cannula 118 also has a bore or lumen 156. A shoulder 136 is formed at one end of the exterior angled surface 134. A complimentary mating shoulder is formed on a delivery portion or cap similar to that illustrated in the previous figures, however, for convenience this is not illustrated in Fig. 7.

[0021] Fig. 8 more clearly illustrates the frangible diaphragm or seal 140, illustrated in Fig. 7. Fig. 8 is a cross section taken along lines 8-8 in Fig. 7. In this embodiment, the frangible diaphragm or seal 140 is formed by a scored or reduced thickness portion 148 circumscribing a substantial portion of the frangible diaphragm 140. A land or hinge 150 is used to secure the frangible diaphragm 140 to the reduced diameter portion 138 when the scored or reduced thickness section 148 is ruptured or broken by the cannula 118, illustrated in Fig. 7.

[0022] Fig. 9 and 10 illustrate another embodiment of the present invention. In this embodiment a twist-off tab forms a frangible seal or diaphragm which is associated with a reduced diameter end of a cartridge or capsule. Referring to Fig. 9, a body portion 210 is adapted to receive a material to be mixed. One end of the body portion 210 has a relatively large opening at one end to receive a plug or piston, not shown in Fig 9. A longitudinal vent 215 is placed in the body portion 210. The vent 215 extends only partially along the length of the body portion 210. Near or adjacent the relatively large opening is a holding portion or collar 212. The holding portion 212 is adapted to be received by any conventional delivery system, such as a syringe. The other end of the body portion 210 has a reduced diameter end or portion 238. The reduced diameter end or portion 238 has a passage therein. The passage has a narrowed diameter

portion 237 intermediate either end of the passage. On one end of the passage is a rear passage opening having an angled surface 239. On the other end of the passage is a front passage opening having an angled surface 235. Associated with the reduced diameter portion 238 is a tab 266. Tab 226 provides a frangible diaphragm or seal 240 to the passage formed by angled surfaces 239 and 235, and seals the passage in the reduced diameter portion 328. The thin walled section 241 permits the tab 226 to be twisted off, broken away, or removed from the reduced diameter portion 238 providing an opening to the passage formed by angled surfaces 239 and 235. An angled surface 234 is formed on the reduced diameter portion 238. At the rear portion of the angled surface 234 is an external shoulder 236.

[0023] Fig 10 schematically illustrates the cartridge or capsule with the twist-off tab 226, illustrated in Fig. 9, removed and a delivery portion 216 attached. The delivery portion 216 is similar to the delivery portion illustrated in the prior figures, and is generally made of plastic with a bendable cannula 218 placed there through. The cannula 218 is preferably made of metal, but also may be made of plastic or other similar material. A rear portion of the cannula 218 is guided by the angled surface 235 through the passage formed thereby and communicates with or extends into the body portion 210. The narrowed diameter portion 237 holds and seals around the cannula 218. The delivery portion 216 is pushed or snap-fit onto the reduced diameter end or portion 238. Flange 228 helps in grasping the delivery portion 216. An internal shoulder 233 formed on the delivery portion mates with the external shoulder 236 formed on the reduced diameter end or portion 238 thereby effecting a snap-fit securely holding the delivery portion onto the body portion 210. A plug 214 is inserted into the relatively large rear opening of the body portion 210. The plug 220 has a plurality of flexible ears or handles 220 that assist in grasping and inserting the plug 214 into the body portion 210. The material 260 within the body portion 210 can be dispensed or extruded by advancing the piston or plug 214 with any conventional applicator, such as a syringe, not shown.

[0024] The operation of this embodiment is readily appreciated with reference to Figs. 9 and 10. A material, preferably a dental material 260, is placed within the body portion 210. The tab 266 forms a frangible diaphragm or seal 240 associated with the reduced diameter end 238 preventing material from escaping from the body portion 210. A plug 214 is inserted into the relatively large opening adjacent the holding portion 212 and the material is mixed, if mixing is required. After mixing, tab 266 is removed. The rear end of cannula 218 in the delivery portion 216 is then placed in the passage formed by angled surfaces 239 and 235. The delivery portion is securely held onto the body portion 210 with the complementary or mating internal shoulder 233 and external shoulder 236. The cartridge is then placed in a dispenser or syringe and the material 260 may then be dispensed or extruded providing accurate and precise placement.

[0025] Fig. 12 and 13 illustrate another embodiment of the present invention. The dental cartridge in this embodiment has a body 310 with a holding or collar portion 312 and an initially closed front portion. The front portion comprises a socket 352 having an internal thread 350 and a frangible nose or tab 366 forming a closed end. The nose or tab 366 has a reduced wall thickness intermediate either end. The nose or tab 366 can be either broken or cut off forming a frangible seal permitting the opening of the closed end. Fig. 12 illustrates the placement of a delivery portion 316 on the front end of the body 310 forming a complete dental cartridge. The delivery portion has a cannula 318 on one end and has a thread 354 on the other end configured to mate with the thread 350 formed within the socket 352. The body portion 310 may have a longitudinal vent 315 formed on the inside of the body portion 310 to facilitate the insertion of a plug, not shown.

[0026] Figs. 13-16 illustrates another embodiment of the present invention. Fig. 13 illustrates the front end of a body portion 410. The front end has opposing hooks 428. The opposing hooks 428 have a inner shoulder 433. The opposing hooks 428 are formed around a reduced cylindrical portion 438. At the end of the reduced cylindrical portion 438 a tab 466 is formed initially closing or sealing the end. Intermediate between the reduced cylindrical portion 438 and the tab 466 is a reduced wall thickness 441. The reduced wall thickness 441 permits easy removal of the tab 466 so that the front end can be opened. Fig. 14 is a front end view that better illustrates the opposing hooks 428. Fig. 15 illustrates the placement of a delivery portion 316 on the front end of the body 410. The delivery portion 316 has a cannula 318 and threads. The delivery portion 316 is the same as the delivery portion illustrated in Fig. 12. Fig. 16 illustrates the placement of another type of delivery portion 416 on the front end of the body 410. The delivery portion 410 has an open nozzle 418 on one end and a flange 419 on the other end. The flange 419 is held by the opposing hooks 428. Accordingly, the front end of body 410 is adapted to hold a variety of different delivery portions 316 and 416.

[0027] Figs. 17 and 18 illustrates another embodiment of the present invention. In this embodiment a delivery portion 516 is held by friction onto the front end of body 510. Body 510 has a reduced cylindrical portion 538 with a closed nose or tab 566 having an intermediate reduced wall thickness 541. As illustrated in Fig. 18, after removal of the closed nose or tab 566 the delivery portion 516 is forced onto the reduced cylindrical portion 538 permitting dispensing of a dental material, not shown, from the nozzle 518.

[0028] Accordingly, it should be appreciated that the present invention, in providing a cartridge that has a snap on or pop on delivery portion or cap, clearly

advances the art in delivering dental material. By permitting the dentist to control and vary the amount of liquid to be mixed with a powder, the volume of material may be increased over existing capsules. Additionally, the viscosity of the material may be easily adjusted by the dentist. The delivery portion or cap may come in a variety of different sized cannulas such that the dentist can choose a particular sized cannula having a particular diameter bore or lumen to be placed on a common cartridge body. This is particularly advantageous in that it permits the dentist to mix or prepare dental material to a desired viscosity or consistency for a particular application. Accordingly, the dentist need not compromise the desired viscosity for use in a particular application because of a limitation of available cannula sizes. The different delivery portions or caps may even be color coded to identify and distinguish the different diameter cannula sizes available. Additionally, different lengths of cannula may be used and selected by the dentist, depending upon application. Further, by providing a cannula extending into the interior space of the delivery portion or cap and using the cannula for rupturing the diaphragm, the rupturing of the diaphragm is assured. Therefore, the diaphragm may be made sufficiently strong so as to avoid any unintentional rupturing and spillage of the dental material prior to being prepared or mixed. The plug facilitates insertion and removal so that the dentist can conveniently prepare the dental material. Typically, a powder is initially placed within the cartridge body and the dental material is prepared by removing the cap or plug and inserting a liquid catalyst within the cartridge body. The cap or plug is then replaced during mixing. The cartridge body is placed into a mechanical mixer or amalgamator prior to placement of the delivery portion or cap thereon. The dentist is assured that the diaphragm or frangible seal will be sufficiently durable so as to avoid any unintentional rupturing of the frangible seal and inadvertent or unintentional dispensing of any material contained within the cartridge body. After mixing the dentist places the delivery portion or cap onto the reduced diameter end causing the frangible seal to rupture. In another embodiment, the dentist simple removes the twist-off tab and then places the delivery portion or cap onto the reduced diameter end. The dental material can then be conveniently dispensed. The cartridges or capsules may be sold empty or pre-filled with material The cartridges may also be pre-filled with one component of material, such as a predetermined amount of powder, and a liquid second component that is placed in the cartridge by the dentist. Additionally, the frangible seal or diaphragm may be place anywhere along the passage formed in the reduced diameter end or portion as long as a temporary seal is provided. The frangible seal need only be associated with the reduced diameter portion or end. Additionally, it should be appreciated that while the present invention has particular applicability to dispensing of dental material, any type of material may be utilized with the present invention.

[0029] While several different embodiments of the present invention have been illustrated and described, it will be obvious to those skilled in the art to apply the teachings of the present invention. As a result, various modifications may be made without departing from the spirit and scope of this invention.

Claims

1. A cartridge comprising:

   a body portion having an open end and a reduced diameter end;
   a holding portion adjacent the open end of said body portion;
   a frangible seal associated with a passage formed in the reduced diameter end; and
   a delivery portion capable of attaching to the reduced diameter end of said body portion,
   whereby when said delivery portion is placed on the reduced diameter portion a material contained within the body portion may be dispensed through said delivery portion.

2. A cartridge as in claim 1 further comprising:

   a cannula placed within said delivery portion.

3. A cartridge as in claim 2 wherein:

   said frangible seal is placed within the reduced diameter end.

4. A cartridge as in claim 1 wherein:

   said frangible seal is placed at one end of a passage formed within the reduced diameter end.

5. A cartridge as in claim 4 wherein:

   said frangible seal comprises a twist-off tab placed at the end of the passage formed within the reduced diameter end.

6. A cartridge as in claim 2 wherein:

   said frangible seal has a plurality of segments with reduced thickness sections.

7. A cartridge as in claim 6 wherein:

   each of the plurality of segments is attached to said body portion with a hinge.

8. A cartridge as in claim 1 further comprising:

a plug, said plug having flexible ears extending radially, whereby said plug can be easily grasped.

9. A cartridge as in claim 1 further comprising:

a vent associated with the open end.

10. A dental cartridge comprising:

a body portion;
a reduced diameter end having an opening;
a diaphragm placed between said body portion and the opening;
a cap;
a cannula placed through said cap, said cannula extending into an interior space of said cap;
locking means, associated with said cartridge and said cap, for firmly attaching said cap onto said body portion, whereby when locked said cannula passes through the opening;
an open end;
a collar adjacent said open end; and
a plug adapted to fit within said open end, whereby dental material placed within said body portion is prevented from being unintentionally dispensed.

11. A dental cartridge as in claim 10 wherein:

said locking means comprises a snap fit.

12. A dental cartridge as in claim 10 wherein:

said locking means comprises mating shoulders.

13. A dental cartridge as in claim 10 further comprising:

a plurality of caps, with each of said plurality of caps having a different sized cannula, whereby a dentist may choose among said plurality of caps depending upon a preference of the dentist.

14. A dental cartridge as in claim 13 wherein:

each of said plurality of caps are a different color.

15. A dental cartridge as in claim 13 wherein:

said plurality of caps are sized base upon length of said cannula.

16. A dental cartridge as in claim 13 wherein:

said plurality of caps are sized base upon diameter of the lumen of said cannula.

17. A dental cartridge as in claim 13 wherein:

said canula is bendable.

18. A dental cartridge as in claim 17 wherein:

said canula is metal.

19. A dental cartridge as in claim 13 wherein:

said canula is plastic.

20. A dental cartridge as in claim 10 further comprising:

a vent associated with said body portion and said plug, whereby air in said body portion is permitted to escape as said plug is inserted into said body portion.

21. A dental cartridge for use in dispensing a dental material needing to be mixed comprising:

a cartridge body made of plastic, said cartridge body having a longitudinal axis;
a reduced diameter portion integrally formed on one end of said cartridge body, said reduced diameter portion having a front open end;
a frangible seal formed within said reduced diameter portion separating the open end from said cartridge body, said frangible seal having a reduced thickness portion extending substantially entirely around its periphery except for a hinge portion, whereby the hinge portion effectively secures said frangible seal to said reduced diameter portion after said frangible seal is ruptured along the reduced thickness portion;
a shoulder formed on said reduced diameter portion, a top surface of said shoulder having an inclined surface, said inclined surface sloping towards the open end at an angle to the longitudinal axis of said cartridge body, a first bearing surface being formed between the top surface and said reduced diameter portion, the first bearing surface being substantially perpendicular to the longitudinal axis of said cartridge body;
a cap having an interior space adapted to fit over said reduced diameter portion, said cap having angled ramps extending into the interior space, the ramps having a second bearing surface adapted to mate with the first bearing surface on said shoulder;
a metal cannula placed through said cap, one

end of said metal cannula extending a predetermined distance into the interior space of said cap sufficiently far to rupture said frangible seal when said cap is placed on said reduced diameter portion and said first and second bearing surfaces are mated to each other;

a rear open end formed in another end of said cartridge body;

a collar adjacent said rear open end adapted to be received by an applicator;

a plug adapted to fit within said rear open end; and

flexible ears extending radially and placed on one end of said plug, whereby said flexible ears are easily grasped for removing said plug yet easily bend to fit within said rear open end of said cartridge body,

whereby components of a dental material to be mixed can be sequentially placed within said cartridge body and mixed without unintentionally rupturing said frangible seal.

22. A dental material delivery system comprising:

a body portion;

a holding end formed in said body portion;

a front end having a reduced cylindrical portion attached to said body portion;

a frangible tab place on said front end initially closing the reduced cylindrical portion; and

a delivery portion adapted to be received by said front end,

whereby dental material may be placed in said body portion and prevented from being dispensed from said front end until said frangible tab is removed and said delivery portion is placed thereon.

23. A dental material delivery system as in claim 22 further comprising:

a plug adapted to be received by said body portion and used to extrude the dental material.

24. A dental material delivery system as in claim 23 further comprising:

flexible ears extending radially from said plug beyond said body portion.

25. A dental material delivery system as in claim 23 further comprising:

a vent associated with said body portion and said plug.

26. A dental cartridge for use in dispensing a dental material needing to be mixed comprising:

a body portion;

a reduced diameter end formed in the cartridge adjacent the body portion and having a passage;

a twist-off tab having a frangible seal sealing the passage;

a cap;

a cannula placed through said cap, said cannula extending into an interior space of said cap;

locking means, associated with said cartridge and said cap, for firmly attaching said cap onto said body portion, whereby when locked said cannula passes through the passage;

an open end;

a collar adjacent said open end; and

a plug adapted to fit within said open end,

whereby dental material placed within said body portion is prevented from being unintentionally dispensed until said twist-off tab is removed.

27. A dental cartridge for use in dispensing a dental material needing to be mixed comprising:

a cartridge body made of plastic, said cartridge body having a longitudinal axis;

a reduced diameter portion integrally formed on one end of said cartridge body, said reduced diameter portion having a passage and a front end;

a twist-off tab forming a frangible seal at the front end of the passage formed in the reduced diameter portion;

a shoulder formed on said reduced diameter portion, a top surface of said shoulder having an inclined surface, said inclined surface sloping towards the open end at an angle to the longitudinal axis of said cartridge body, a first bearing surface being formed between the top surface and said reduced diameter portion, the first bearing surface being substantially perpendicular to the longitudinal axis of said cartridge body;

a cap having an interior space adapted to fit over said reduced diameter portion, said cap having angled ramps extending into the interior space, the ramps having a second bearing surface adapted to mate with the first bearing surface on said shoulder;

a metal cannula placed through said cap, one end of said metal cannula extending a predetermined distance into the interior space of said cap sufficiently far to enter the passage within said reduced diameter portion and said first and second bearing surfaces are mated to each other;

a rear open end formed in another end of said

cartridge body;
a collar adjacent said rear open end adapted to be received by an applicator;
a plug adapted to fit within said rear open end; and
flexible ears extending radially and placed on one end of said plug, whereby said flexible ears are easily grasped for removing said plug yet easily bend to fit within said rear open end of said cartridge body,
whereby components of a dental material to be mixed can be sequentially placed within said cartridge body and mixed without unintentionally rupturing the frangible seal.

28. A method of mixing and dispensing a dental material comprising the steps of:

placing a first dental material within a cartridge having a body and a reduced diameter open end;
sealing the cartridge with a plug;
storing the cartridge and first dental material until desired;
placing a frangible seal between the first dental material and the reduced diameter open end of the cartridge
removing the plug;
placing a second dental material within the cartridge;
re-sealing the cartridge with the plug;
mixing the first and second dental materials together forming a mixed dental material;
attaching a cap having a cannula there through onto the reduced diameter open end of the cartridge, wherein the cannula extends a predetermined distance and ruptures the frangible seal when attached to the reduced diameter open end; and
dispensing the mixed dental material to a patient,
whereby a dentist may selectively adjust the mixed dental material by placement of a selected amount of the second dental material within the cartridge.

29. A method as in claim 28 wherein:

the first dental material is a powder; and
the second dental material is a liquid.

30. A method as in claim 28 further comprising the steps of:

the first dental material is a paste; and
the second dental material is a liquid.

31. A method of mixing and dispensing a dental material comprising the steps of:

placing a first dental material within a cartridge having a body and a reduced diameter end having a passage closed by a twist-off tab;
sealing the cartridge with a plug;
storing the cartridge and first dental material until desired;
removing the plug;
placing a second dental material within the cartridge;
re-sealing the cartridge with the plug;
mixing the first and second dental materials together forming a mixed dental material;
removing the twist-off tab, whereby the passage is opened;
attaching a cap having a cannula there through onto the reduced diameter open end of the cartridge, wherein the cannula extends a predetermined distance into the passage; and
dispensing the mixed dental material to a patient,
whereby a dentist may selectively adjust the mixed dental material by placement of a selected amount of the second dental material within the cartridge.

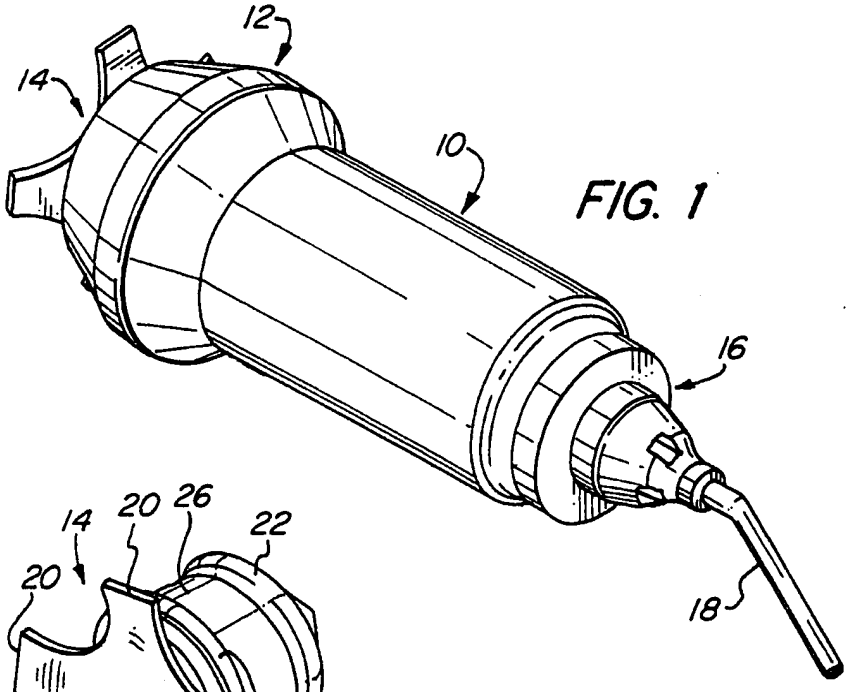

FIG. 1

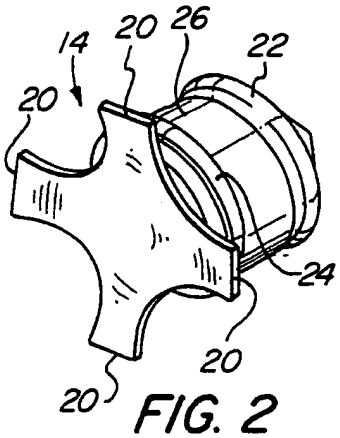

FIG. 2

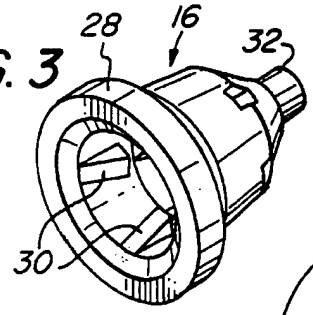

FIG. 3

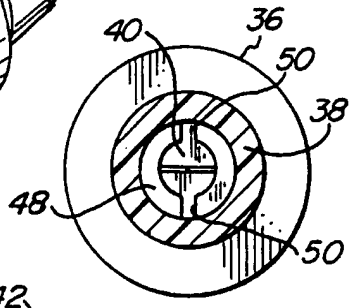

FIG. 5

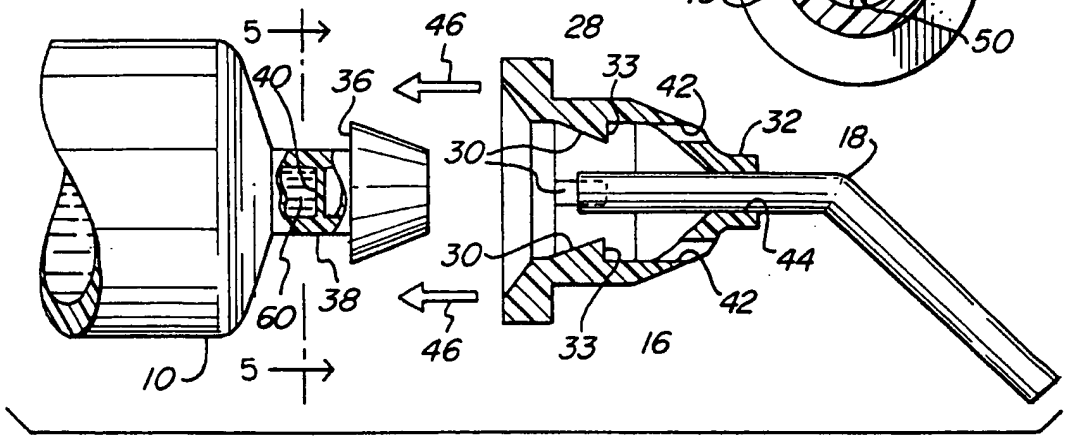

FIG. 4

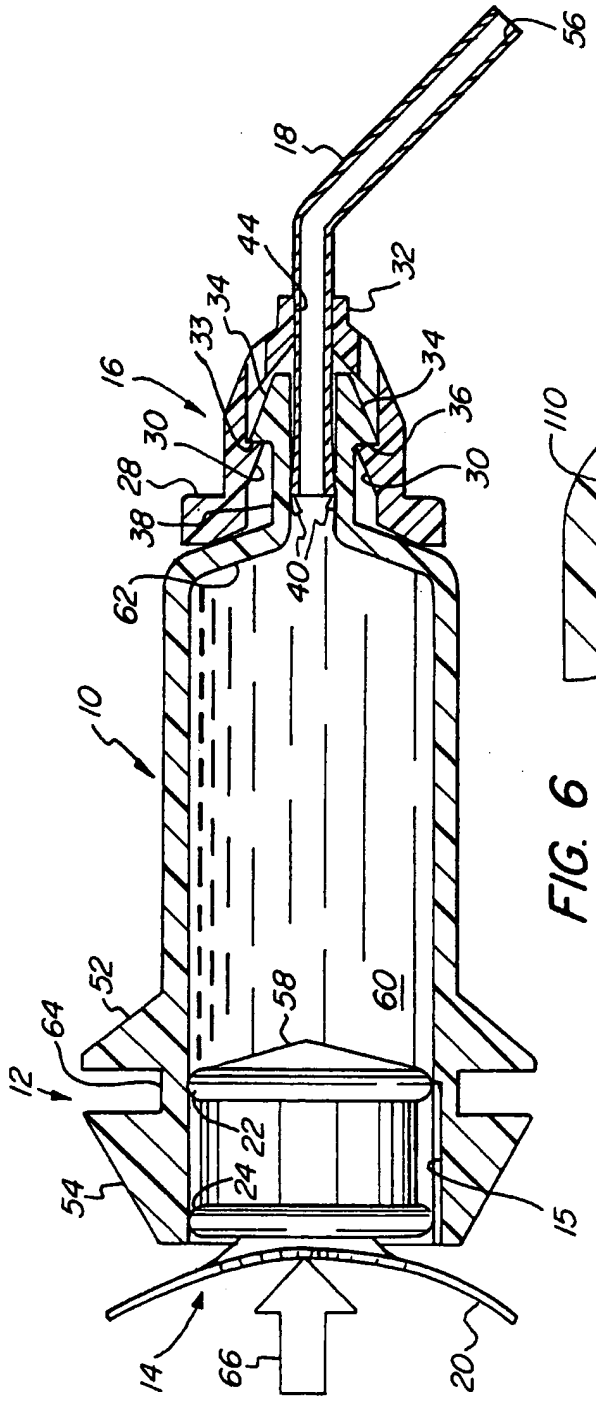

FIG. 6

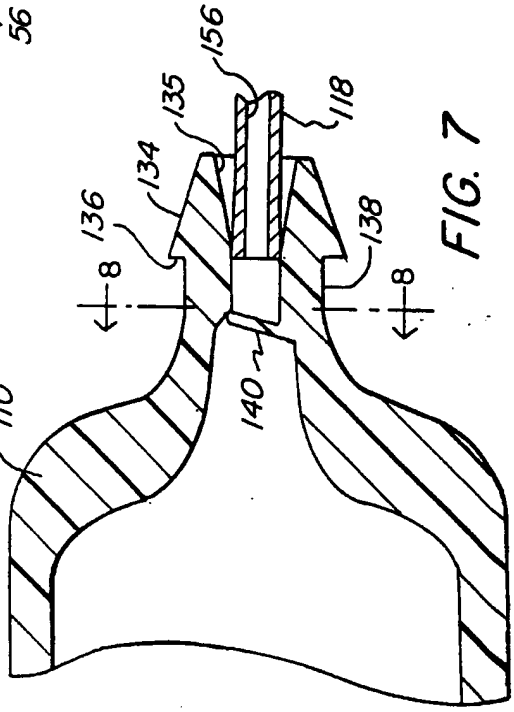

FIG. 7

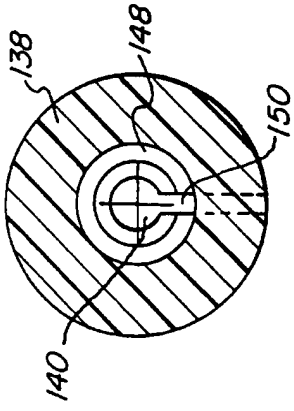

FIG. 8

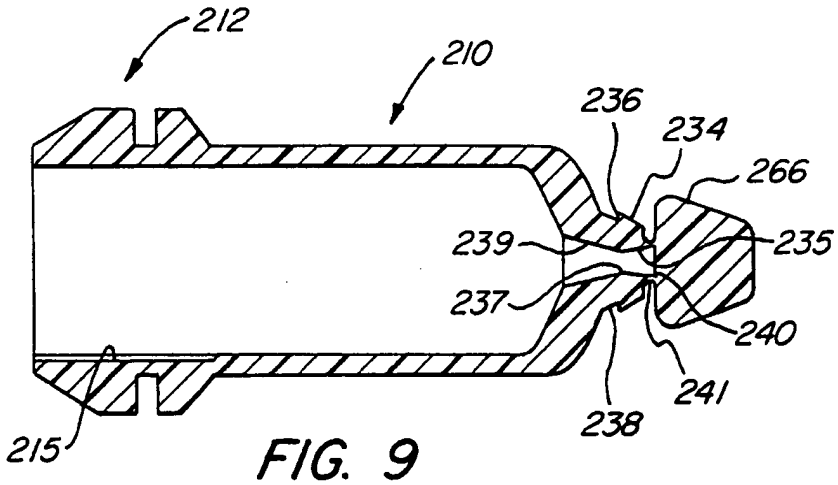
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FIG. 9

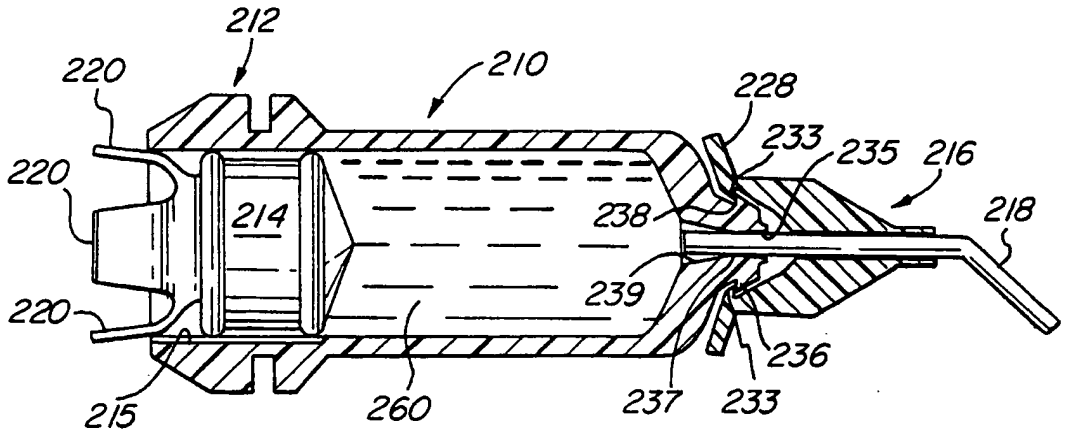
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FIG. 10

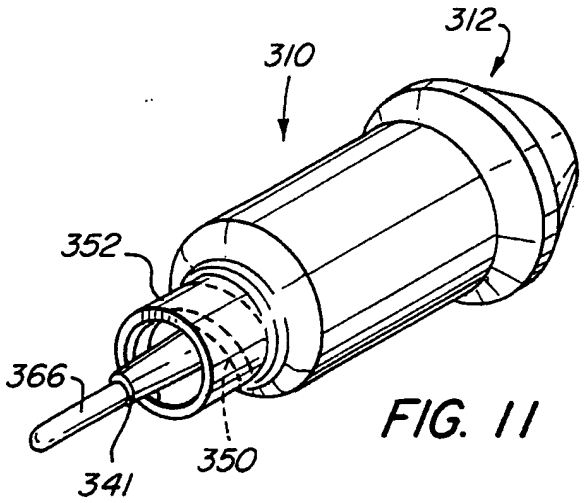

FIG. 11

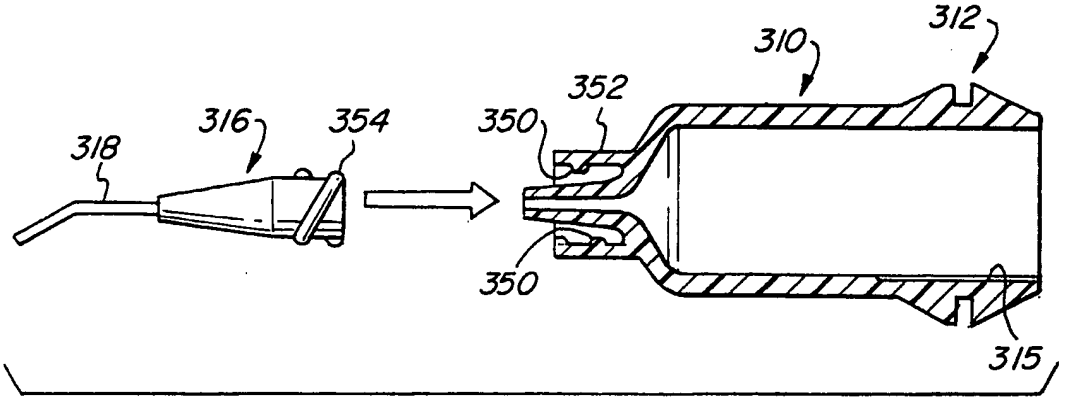

FIG. 12

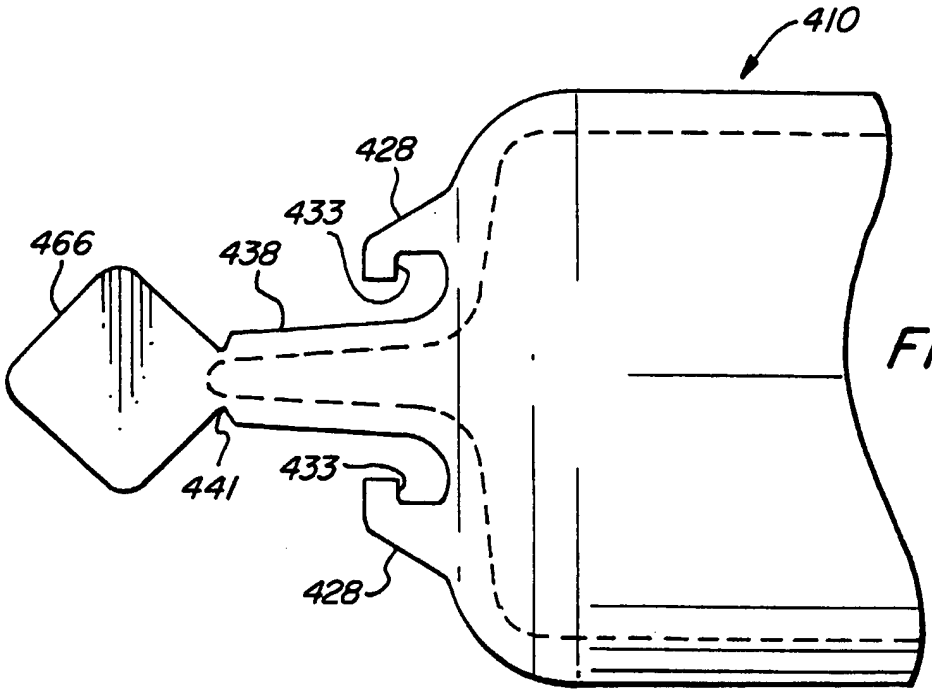

FIG. 13

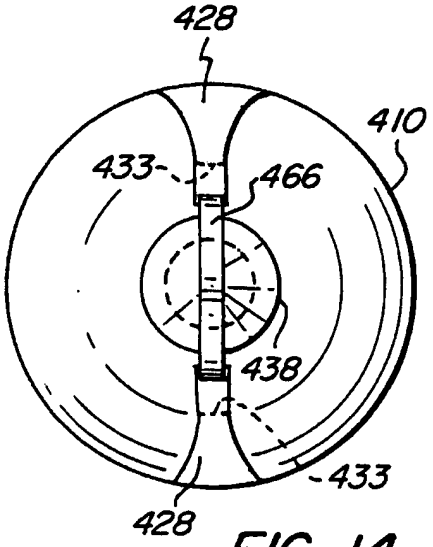

FIG. 14

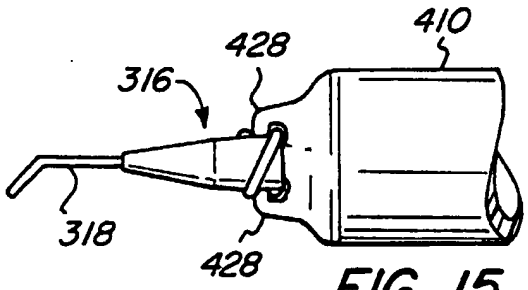

FIG. 15

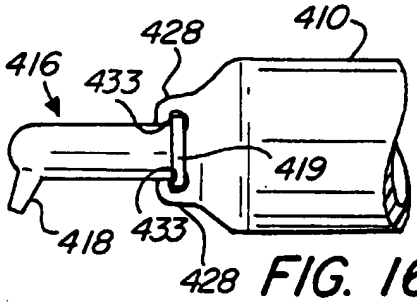

FIG. 16

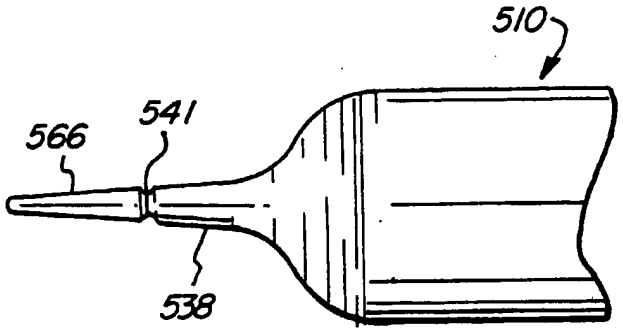

FIG. 17

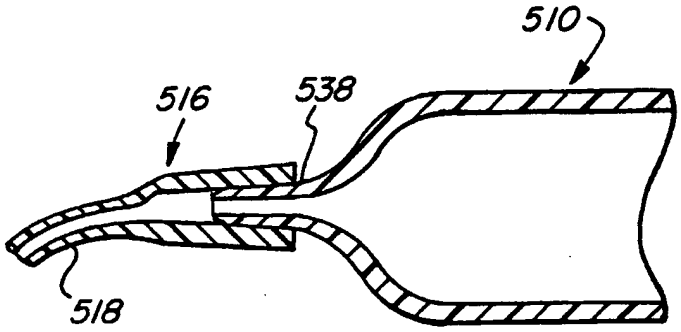

FIG. 18